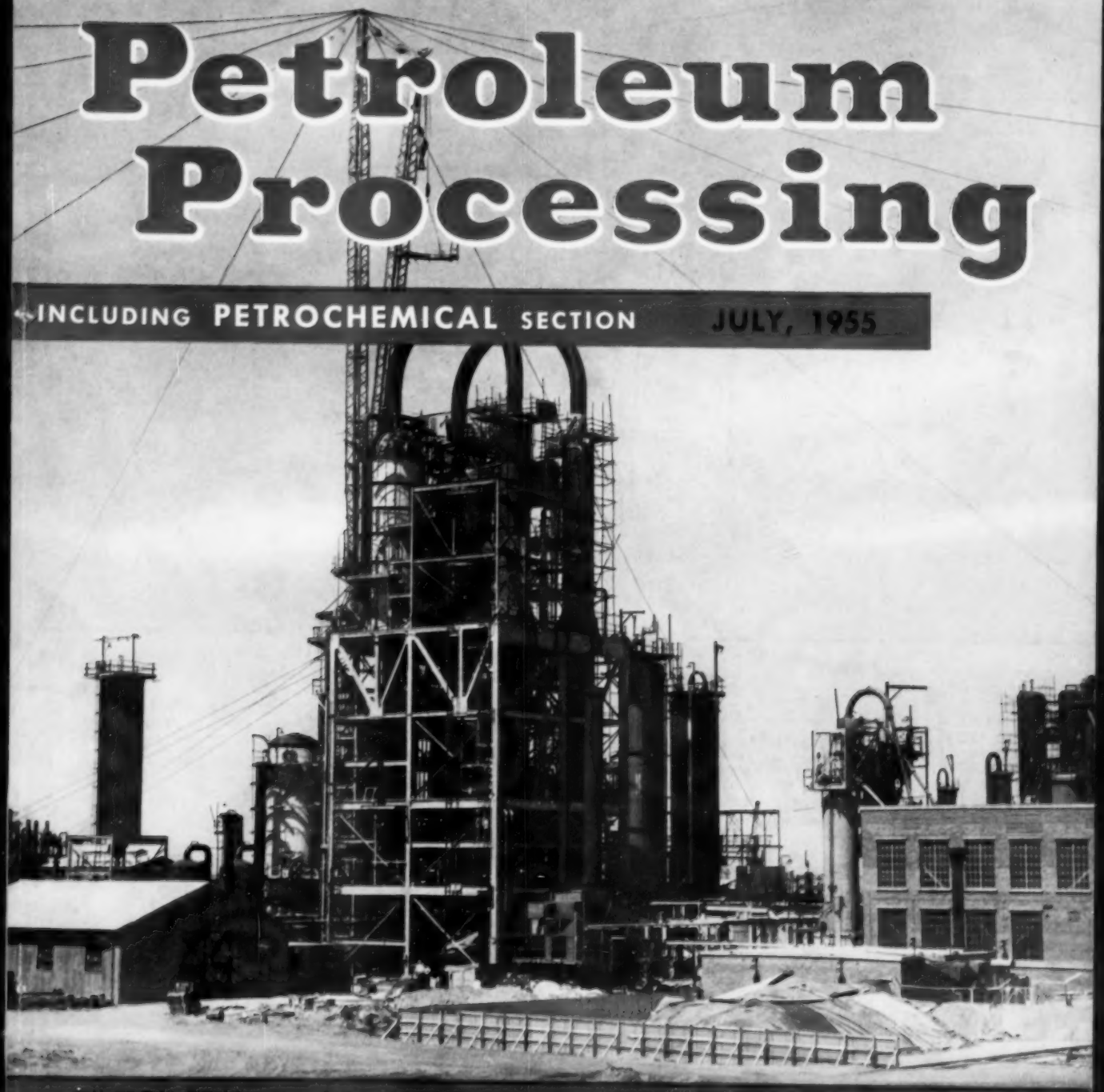
Petroleum Processing

INCLUDING **PETROCHEMICAL** SECTION **JULY, 1955**



OIL-FROM-COAL — First full-scale plant onstream in South Africa — p. 985

AUTOMATIC LOGGING — It has an important place in your future . . . . p. 992

STANDARDIZE YOUR MAINTENANCE — The 'impossible' pays off . . . . . p. 996

WHAT DOES ACETYLENE MEAN TO YOU? — A special 12-page report . . . p. 1011

A McGRAW-HILL PUBLICATION

HUDSON Solo-aire and Combin-aire COOLING UNITS

minimize water consumption in the Pegasus Plant of Magnolia Petroleum Company, Midland County, West Texas

Pictured in the foreground is the HUDSON Combin-aire unit, with Solo-aire units in the background. Air is used directly for cooling in the Solo-aires where low temperatures are not required. The Combin-aire uses a small quantity of water to precool the air so that entering hot fluids may be cooled to effluent temperatures lower than those obtainable by direct use of air.

If the total heat load of this plant had been dissipated thru a conventional cooling tower, 158 million gallons of water per year would have been required for makeup. The actual annual water makeup for the plant is only 17 million gallons per year. In this plant the use of the Solo-aire and Combin-aire have proven advantageous, resulting in savings in first cost, in operating costs for horsepower, water treating, and maintenance, and in obviating necessity for drilling of several water wells. Savings in cost of piping result thru installing the Combin-aire in close proximity to process equipment, made possible because the effluent high temperature air is always undersaturated with water vapor and nuisance and high maintenance cost due to water carryover or condensation are eliminated.

New bulletin
"Cooling with Air"
mailed upon request

HUDSON
ENGINEERING CORPORATION
FAIRVIEW STATION • HOUSTON, TEXAS

IN SURFACE COATINGS (*Paint, Varnish, Shellac*)

IN PETROLEUM (*Gasoline Additives, Lubricants*)

IN CHEMICALS (*Synthetic Fabrics and Yarns*)

Enjay assures you satisfied customers

To satisfy your customers with high quality, dependable products, specify Enjay chemicals. The Enjay Company supplies a diversified line of uniform, high quality petroleum chemicals to the surface coating, chemical and petroleum industries. Through the facilities of the *new Enjay Laboratories* you can be assured of the best application of Enjay products in your chemical needs.

PETROLEUM	SURFACE COATING	CHEMICAL
PARANOX	PETROMOL 91	PETROMOL 91
PARATONE	PETROMOL 95	PETROMOL 95
PARAFLOW	PETROMOL 99	PETROMOL 99
PARAPOID	JAYSOL	JAYSOL
PARADYNE	Secondary Butyl Alcohol	Iso-Octyl Alcohol
PARATAC	Secondary Butyl Acetate	Decyl Alcohol
PETROMOL	Isopropyl Acetate	Denatured Ethyl Alcohol
Methyl Ethyl Ketone	Acetone	Tridecyl Alcohol
Dewaxing Aid	Methyl Ethyl Ketone	Dicyclopentadiene
Ethyl Ether	Dicyclopentadiene	Isoprene
Isopropyl Ether	Ethyl Ether	Butadiene
Reference Fuels	Isopropyl Ether	Ethyl Ether
	Naphthenic Acids	Isopropyl Ether
RUBBER	Iso-Octyl Alcohol	Tetrapropylene
ENJAY BUTYL	Decyl Alcohol	Tripropylene
VISTANEX	Denatured Ethyl Alcohol	Aromatic Tars
		Benzene
		Acetone
		Methyl Ethyl Ketone

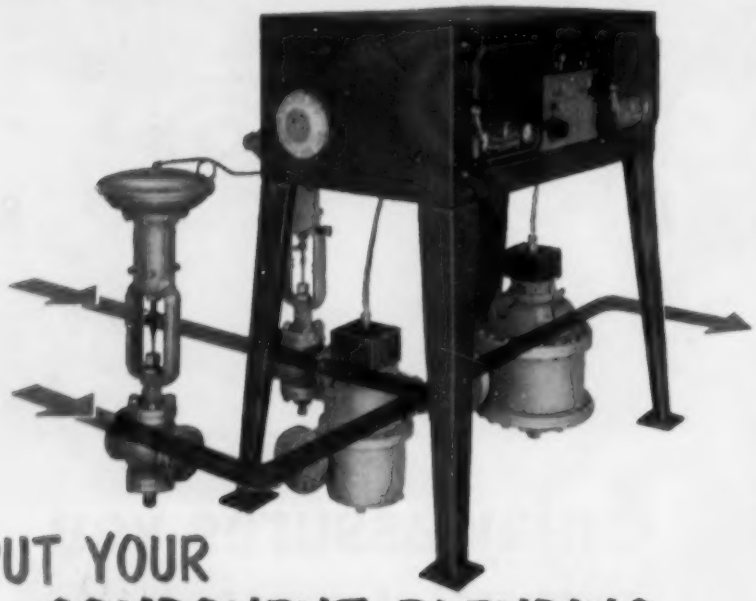
ENJAY

35 successful years of leadership in serving industry

Enjay Company, Inc. • 15 West 51st St., New York 19, N. Y.

Other Offices: Akron • Boston • Chicago • Tulsa

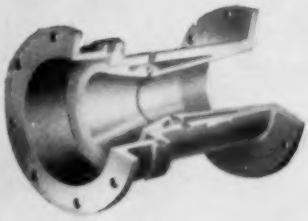
B-I-F METERS FEEDERS CONTROLS for the **PETROLEUM** industry



PUT YOUR COMPONENT BLENDING "ON STREAM"

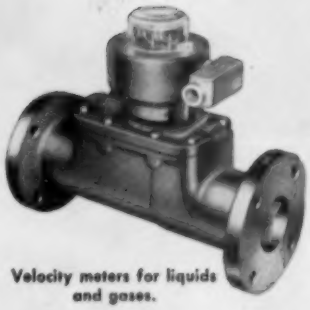
This Proportioneers "package" blender puts component blending on a continuous and automatic basis. It is readily adaptable to the handling of both heavy and light components such as asphalts, bunker fuels, Diesel fuels, lube oils, gasolines, butane, propane, and solvents, required in the production of finished gasolines, fuel oils, heating oils, etc. Blend percentages are manually adjustable, and a "dry run" can be made to check the blend setting. Equipment includes positive interlocks for "fail-safe" operation.

Proportioneers stream blending systems — for two or more components — are now serving refineries in the United States and 16 foreign countries. Our experience in engineering, manufacturer and service of complete blending systems is at your disposal. Write Proportioneers, Inc., 447 Harris Ave., Providence 1, Rhode Island.



Differential producers for liquids and gases.

Chlorine gas feeders.



Velocity meters for liquids and gases.

PROPORTIONEERS

DIVISION OF B-I-F INDUSTRIES, INC.

BUILDERS IRON FOUNDRY • OMEGA MACHINE CO. • BUILDERS-PROVIDENCE, INC.

B-I-F METERS FEEDERS CONTROLS

(To obtain more data on advertised products see page 1056)

Petroleum Processing

Covering petroleum and petrochemical research and the design, construction, management, operation and maintenance of plants processing hydrocarbon materials into fuels lubricants and chemicals.

July, 1955
Vol. 10, No. 7

Contents

FEATURE ARTICLES

Refining Section

Oil From Coal—Full Scale 985
South Africa's Sasol plant—what it's like, why it was built—by V. S. Swaminathan

Keep Those Pressure Vessels Safe 989
Part 4 of a series—pressure relieving devices and systems, by Walter Samans

Do You Need Automatic Logging? 992
Chances are good that you do, and here are the reasons why

API Refiners Mark 25 Years 994
Our Candid Cameraman snapped these at the Refining Division's midyear meeting

Standardized Maintenance Pays 996
Atlantic Refining found six "profit points" when they tried it, by Frank O. Pierson

Technical Tips on Processing Problems 1002
Cat cracking and treating are discussed in this installment of the WPRA meeting

Petrochemical Section

Acetylene—a Challenge 1011-1023
A special 12-page report, covering the following five important factors, by Marshall Sittig

How Much Will Be Needed? 1012

How Much Will Be Used? 1014

How Will It Be Made? 1016

How Will It Be Handled? 1020

What About the Future? 1022

From Butadiene to Petrochemicals 1024
What's ahead for a former government plant now in private hands, by D. P. Thornton, Jr.

DEPARTMENTS

Publisher's Page 953
What's Happening 955
Tomorrow 959
Operating Trends 965
News in Views 991
New Words 1025
Plant Practices 1027
Personals 1033
Patents 1039
Suppliers 1047
Meetings 1053
Information Offered 1054
Advertisers' Index 1056
What's New 1057
Editorial 1088

A McGRAW-HILL PUBLICATION

Member of Associated Business Publications and Audit Bureau of Circulations

Petroleum Processing is published monthly by McGraw-Hill Publishing Co., Inc., James H. McGraw (1860-1948) founder.

Publication Office: 330 West 42nd St., New York 36, N. Y.

Executive, Editorial and Advertising Offices: McGraw-Hill Building, 330 West 42nd St., New York 36, N. Y. Donald C. McGraw, President; Paul Montgomery, Executive Vice-President; Joseph A. Gerardi, Vice-President and Treasurer; John J. Cooke, Secretary; Nelson Bond, Executive Vice-President, Publications Division; Ralph B. Smith, Vice-President and Editorial Director; Joseph H. Allen, Vice-President and Director of Advertising; J. E. Blackburn, Jr., Vice-President and Circulation Director.

Subscriptions: Address correspondence to Petroleum Processing, Subscription Service, 330 West 42nd St., New York 36, N. Y. Subscription rates: domestic single copies, 35c, U. S. and possessions, Canada, and all other countries, $2 per year, $3 for two years, $4 for three years. Orders must indicate company and position.

Published prior to Sept. 1946 as the Technical Section of National Petroleum News, devoted to Refinery Management and Petroleum Chemical Technology, and including International Petroleum Technology. Entered as second class matter March 12, 1954, at the Post Office in New York, New York, under the act of March 3, 1879. Printed in U.S.A. Copyright 1955 by McGraw-Hill Publishing Co., Inc. All rights reserved.

WIGGINS DOUBLE PONTOON FLOATING ROOFS

Safest Storage for Your "Liquid Assets"

Performance records prove that Wiggins Double Pontoon Floating Roofs soon pay for themselves in liquid conserved. Only Wiggins Double Pontoon Floating Roofs have every important feature for maximum conservation . . . safest operation . . . low-cost maintenance.

Triple Seal increases conservation savings and adds extra safety.

Multiple gas-tight pontoon compartments increase safety, strength and buoyancy.

Simplified design gives strength with minimum trussing, making inspection and maintenance easy.

Complete, clean drainage reduces corrosion problems.

Get the full story on the General American-Wiggins system of petroleum liquid conservation by writing us on your letterhead for the new Wiggins Manual WP-14.

Wiggins Double Pontoon Floating Roofs, Dry Seal Gasholders, Lifter Roofs, Cone Roofs

GENERAL AMERICAN TRANSPORTATION CORPORATION

135 SOUTH LA SALLE STREET · CHICAGO 90, ILLINOIS

Petroleum Processing

Publisher's Page

A McGRAW-HILL PUBLICATION

Editorial & Business Offices
330 West 42nd St., New York 36, N.Y.

Harry L. Waddell, *Publisher*

Editorial Staff

William F. Bland, Editor

William C. Uhl, Managing Editor

Virgil B. Guthrie, Associate Editor

Robert L. Davidson, Assistant Editor

William A. Caperell, Jr., Art Director

Stuart D. Boynton, Editorial Assistant

Grace McKay, Editorial Assistant

D. P. Thornton, Jr., Southwestern Editor
W724 Prudential Bldg., Houston 25

Richard R. Elwell, West Coast Editor
1111 Wilshire Blvd., Los Angeles 17

Andrew R. Patla, Washington Editor
1188 Nat'l. Press Bldg., Washington 4

Peter J. Gaylor, Patent Reviewer

Business Staff

K. W. McKinley, Advertising Sales Mgr.

R. E. Loyer, Business Mgr.

John E. Thompson, Production Mgr.

Regional Sales Representatives

NEW YORK 36, N. Y.
Fred R. Emerson, 330 West 42nd St.
Walter W. Patten, 330 West 42nd St.

PHILADELPHIA 3, PA.
C. J. Jefferis, 17th and Sansom Sts.

ATLANTA 3, GA.
S. T. Henry, 801 Rhodes-Haverty Bldg.

CLEVELAND 15, OHIO
William R. Freeman, 1510 Hanna Bldg.

CHICAGO 11, ILL.
Robert W. Bruley, 520 N. Michigan Ave.

HOUSTON 25, TEXAS
George Reid, W724 Prudential Bldg.

DALLAS 1, TEXAS
J. H. Cash, First Nat'l Bank Building

SAN FRANCISCO 4, CALIF.
T. Evans Wyckoff, 68 Post St.

LOS ANGELES 17, CALIF.
William C. Woolston, 1111 Wilshire Blvd.

So You Think Editing Is Simple?

We've tried something a little out of the ordinary for this issue —and I think you'll find the result is a group of articles which is comprehensive, well-organized and thoughtful.

I'm referring to "Acetylene—A Challenge to the Petrochemical Industry," by Marshall Sittig (pg. 1011). Unusual feature is the way Marshall and our staff collaborated in presenting the story.

(Marshall, by the way, is a bit of a paradox. His is one of our better-known bylines, yet our readers know little about him. Aside from being a free-lance technical writer, Marshall is a chemical engineer, Purdue '40, has worked for Standard of California, DuPont, Eastern Corp., Chrysler, and is now with Ethyl Corp. in New York in sales development. He and his family—one wife, three children—live in Larchmont, N.Y.)

Getting back to the acetylene stories, the idea originated with Marshall. He outlined it to me over lunch some months ago, his thought being that the acetylene picture was changing so fast that there was need for a clean, sharp appraisal of the subject and a searching look at its future. His further thought was that the picture was so involved that half the success of his piece would lie in its presentation in print—layout, illustrations, typography.

Because he knew the sort of editing job we would do, Marshall wanted us to work with him on the story and to publish it.

After our basic agreement on the scope of his piece, Marshall put together an outline and sketched his ideas of how it would look—about which he now says that "any resemblance to the finished product is strictly coincidental." He submitted his ideas and several of our staff proceeded to give them a thorough working over. Another staff meeting, this time with Marshall, and we hammered out a revised outline. Marshall then went to work putting some meat on the skeleton, and in March submitted his first rough draft.

Another staff conference, more changes by Marshall, some final editing—and the manuscript was turned over to our art director, Bill Caperell, who had been in this deal almost from the start. But Marshall's part in the publishing of his baby wasn't finished. He checked diagrams, charts and final layouts; when we came to putting together the pages we enlisted his help via air mail and a 30-minute phone call (he was out of town that week) to make things fit.

We don't give all contributors as rough a time as we gave Marshall, and I'm not sure he'd submit himself to the ordeal again. After it was over I asked him what he thought of the program—and his sage comment was: "I'm glad you're the editor; there's too much work between writing and reading!"

William F. Bland

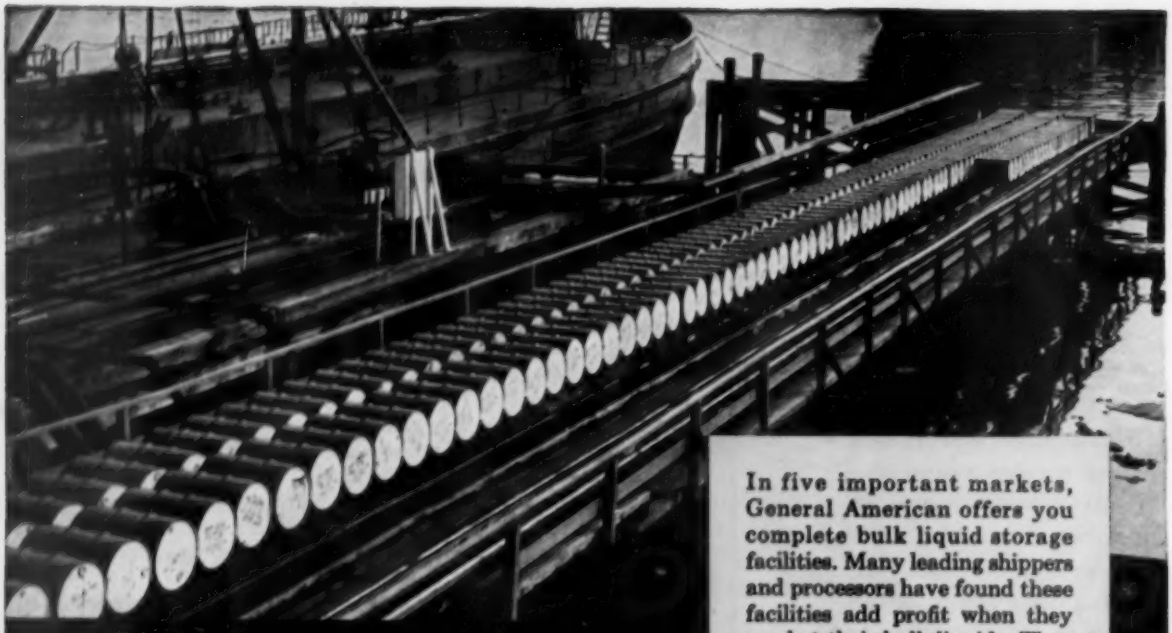
Editor

Other McGraw-Hill Petroleum Publications

National Petroleum News
The monthly oil marketing magazine, covering news, prices, transportation, storage, merchandising.

Platt's Oilgram News Service
A daily independent oil-news reporting service issued from New York, Chicago and Houston.

Platt's Oilgram Price Service
A daily independent oil-price reporting service issued from New York, Chicago and Houston.



Store and Distribute
your bulk liquids
as the market demands—
with no capital investment

GENERAL AMERICAN TANK STORAGE TERMINALS
a division of GENERAL AMERICAN TRANSPORTATION CORPORATION
135 South LaSalle Street · Chicago 90, Illinois

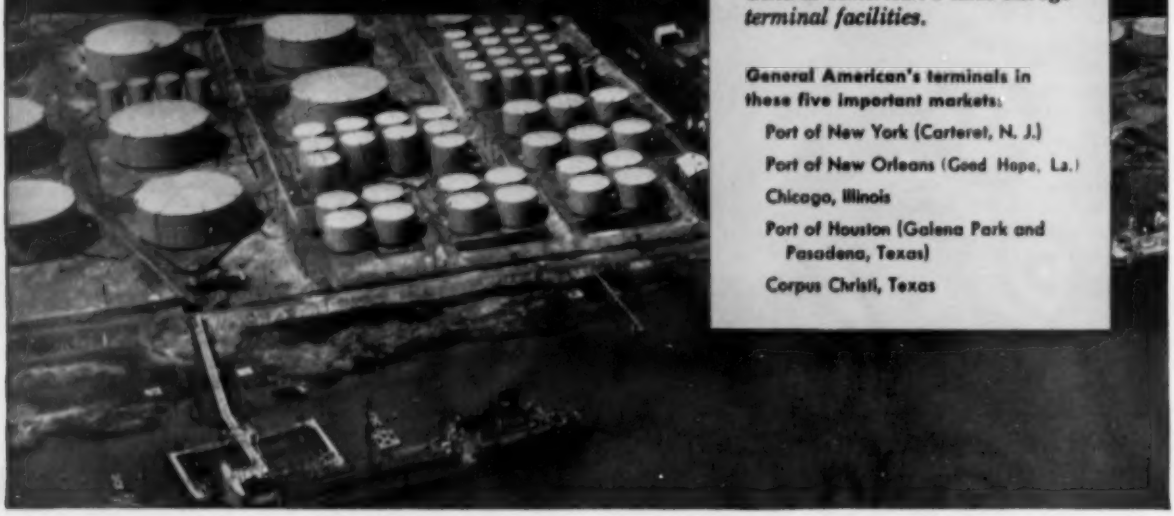
In five important markets, General American offers you complete bulk liquid storage facilities. Many leading shippers and processors have found these facilities add profit when they market their bulk liquids. They can maintain inventories of their products for distribution at the right time and place; gain economies of shipping in bulk; and *conserve* capital.

Modern storage tanks . . . for anything that flows through a pipeline . . . are yours to use. You can be sure of privacy. Carefully guarded manifolds, pipes and pumps to protect your product against contamination. Barrelling, drumming, canning and blending services at New York, New Orleans and Chicago. All this, without capital investment on your part!

Ask about the marketing advantages you receive from leasing General American's tank storage terminal facilities.

General American's terminals in these five important markets:

- Port of New York (Carteret, N. J.)
- Port of New Orleans (Good Hope, La.)
- Chicago, Illinois
- Port of Houston (Galena Park and Pasadena, Texas)
- Corpus Christi, Texas



What's Happening

in Refining

. . . **Great Plains Refinery Development Co.** has awarded a construction contract to Graver Construction Co. for a $3,500,000 refinery at Rapid City, S. D.

. . . **Carter Oil Co.** has let contract to Fluor Corp. for construction of a 2500 b/d Fluid Hydroforming unit and 6900 b/d Hydrofiner at Billings, Mont., with completion planned for January, 1956.

. . . **El Dorado Refining Co.** plans a 2500 b/d UOP Platforming unit at El Dorado, Kans. Engineering design has been completed and construction contract will be awarded shortly.

. . . **Gulf Oil Corp.** will build two new 20,000 b/d units for desulfurizing and upgrading furnace oil to quality home heating oils at Port Arthur, Texas. M. W. Kellogg Co. is the contractor.

. . . **Pure Oil Co.** has awarded a contract for engineering and construction of a 15,000 b/d platinum type catalytic reformer and a 20,000 b/d feed preparation unit at Smiths Bluff, Texas, refinery, to the Ralph M. Parsons Co. Completion is expected by next spring.

. . . **Big West Oil Co.** has awarded contracts for construction of a $500,000 catalytic reformer of 1000 b/d capacity at its Kevin, Mont., refinery. Of UOP design, the Platformer will be built by Procon, Inc., with completion scheduled for October 1.

. . . **The Texas Co.** has awarded Fluor Corp. a contract for design, engineering, and construction of a 4800 b/d UOP Unifiner-Platformer unit at Casper, Wyo., with completion planned for early next spring.

. . . **Standard Oil Co. (Indiana)** will build a 6000 b/d Ultraformer at its Mandan, N. D., refinery. Ralph M. Parsons Co. has the construction contract, and completion is scheduled for next spring.

. . . **Phillips Petroleum Co.** plans construction of a 16,000 b/d catalytic reforming unit at Kansas City, Kans., with Procon Inc. holding the contract and completion expected by spring of 1956.

. . . **Consumers Cooperative Ass'n.** will let contracts this summer for three new process units at its Coffeyville, Kans., refinery. All of UOP design, the units include a 5000 b/d Platformer, a 3000 b/d Unifiner, and a 7000 b/d delayed coker. Completions are planned for early summer, 1956.

. . . **Richfield Oil Corp.** will start building this summer its first catalytic reformer, a Sinclair-designed 17,000 b/d unit at Watson, Calif., using Baker-Sinclair platinum catalyst. Completion is planned by next summer.

. . . **Four new southwestern gas processing plants** announced recently include the following:

At Lindsay, Okla., a natural gas liquids extraction plant, jointly by Phillips Petroleum Co. and Magnolia Petroleum Co., at a cost in excess of $3,500,000.

In Andrews County, Tex., a natural gas liquids extraction plant with an initial capacity of 33,000,000 cfd., by Phillips Petroleum Co.

In Coke County, Texas, a gasoline plant of undisclosed cost or size, Fluor Corp. will build, for Texas Natural Gasoline Corp.

In Acadia Parish, La., a 27,000,000 cfd. plant, by Sunray Oil Corp. Tuloma Builders, Inc., has the contract.

. . . **New construction projects** approved for fast tax write-offs recently include the following:

Pennzoil Co., $850,000 for a 3400 b/d mild hydrogenation unit and a 2700 b/d catalytic reforming unit at McClintock, Penna.

Sinclair Refining Co., $295,000 for expansion of the Fluid catalytic cracking unit at Houston, Tex.

Cosden Petroleum Corp., $416,000 for revamp of crude still to increase capacity from 5000 to 8000 b/d at Big Spring, Tex.

Atlantic Refining Co., $450,000 for auxiliary refining facilities for jet fuel blending and treating at Philadelphia, Penna.

Humble Oil & Refining Co., $1,431,000 for increase in alkylation unit capacity by 2500 b/d at Baytown, Tex.

The Texas Co., $175,179 for compression facilities at Fuller Natural Gasoline plant, Scurry County, Tex.

Gulf Oil Corp., $1,957,000 for a 17,000 b/d visbreaker and auxiliaries at Philadelphia, Penna.

Humble Oil & Refining Co., $430,000 for modifications to light ends unit at Baytown, Tex.

in Petrochemicals

. . . **Petro-Tex Chemical Corp.,** a joint venture of Food Machinery & Chemical Corp. and Tennessee Gas Transmission Co., has been formed to own and operate the 90,000 ton/yr butadiene plant in Houston recently purchased from the government. (See article this issue, pp 1024-25.)

. . . **Ethyl Corp. of Canada Ltd.** has awarded design and construction contract for new $14,000,000 antiknock plant at Sarnia, Ont., to C. F. Braun of Canada.

. . . **United Carbon Co.** has signed contract with the Rubber Producing Facilities Disposal Commission for purchase of the 44,000 ton/yr. GR-S copolymer plant at Baytown, Tex. Sales price was $7,153,000. Two more government synthetic rubber facilities remain unsold: the alcohol butadiene plant at Louisville, Ky., (now leased), and the GR-S copolymer plant at Institute, West Va.

. . . **Societe Chimique des Derives du Petrole** will build a new petrochemical plant near Antwerp, Belg., to produce ethylene oxide and glycol, with completion scheduled in 1956. Costing an estimated $8,000,000, the project will use a catalytic process developed by Scientific Design Co., Inc., of New York, who have been awarded contracts for design and engineering. It will be the third plant by SD for the manufacture of ethylene oxide by direct oxidation.

. . . **Lion Oil Co.'s** expectations for diversification in petrochemical products, based on recent report of research activities indicates such items as acetylene, acrylonitrile, vinyl chloride, urea, polymer development, and ammonia pulping.

. . . **Gulf Oil Corp.** plans installation of sulfur recovery facilities at Port Arthur, Texas, in connection with installation of desulfurizing units for its fuel oil processing. Expected production will be 20 to 40 ton/day.

. . . **Ammonia Chemical Corp. of Calif.** will build its $3,250,000 anhydrous ammonia-from-natural gas plant in the Red Top district, near Merced, Calif. Planned capacity is 36,000 ton/yr. of products.

. . . **Arthur G. McKee & Co.** has signed an agreement with The Uhde Corp. of New York, a subsidiary of Friedrich Uhde, GmbH, Dortmund, Germany, to use a number of German chemical processes in plant construction in the U.S. and territories and in Canada.

The processes include those for manufacture of ammonia and related nitrogen products, carbon disulfide, formaldehyde, methanol, polystyrene, etc.

. . . **Stauffer Chemical Co.** will build a carbon disulfide plant at Mobile, Ala., with estimated completion date in spring, 1956. Location was chosen for its favorable relationship to natural gas and sulfur, according to Stauffer. Size of plant was not disclosed, and cost was said to be multi-million dollar.

. . . **Celanese Corp. of America** will double the capacity of its 30,000,000 lb/yr vinyl acetate plant at Pampa, Tex., for an estimated cost exceeding $2,500,000.

. . . **Temporary excess of nitrogen fertilizers** for next four or five years is seen by Lion Oil Co.'s president T. M. Martin, due mainly to new production capacity for ammonia now building. However, by end of five years, he sees situation reversing again, with more new capacity again needed.

in Foreign Operations

. . . **The Syrian Parliamentary Oil Commission** is studying a proposal by a Yugoslav construction agency to build Syria's first oil refinery, a 12,000 b/d plant near Homs, to cost $3,000,000.

. . . **Shell de Venezuela** plans to spend $36,000,000 this year on new installations at its Punta Cardon refinery, including a catalytic cracking unit, polymerization unit, two treaters, and two feed preparation units.

. . . **Petroleos Mexicanos** expects to complete by end of 1955 a new $8,500,000 absorption plant at Reynosa, with a capacity of 300,000,000 cfd., operating on natural gas from the Tamaulipas fields, and recovering 8000 b/d of product.

. . . **Plan of small Italian business group** in Milan for building a 5000 b/d refinery at Gaeta has been approved by the Interministerial Oil Committee of the Italian government. Gaeta is on Mediterranean coast, north of Naples.

. . . **Venezuela Gulf Refining Co.** is considering installation of an 8000 b/d catalytic cracking unit at its 30,000 b/d refinery at Puerto La Cruz.

in Markets and Prices

. . . **The high level of crude runs** to stills in the first half of the month—and the consequent sharp rise in distillate fuel inventories and relatively small decline in motor fuel stocks—were the cause of increasing concern among refiners at mid-June.

Prices for light fuels dropped 0.25¢ to 0.5¢/gal in the mid-Continent. At the Gulf, where prices had already sloughed off 0.75¢ from winter peaks, refiners were fearful that unwieldy heating oil inventories would bring still deeper cuts in quotations. But concern was greatest over gasoline—refiners remember only too well the nose dive that prices took at the peak of last year's summer season when inventories got out of hand.

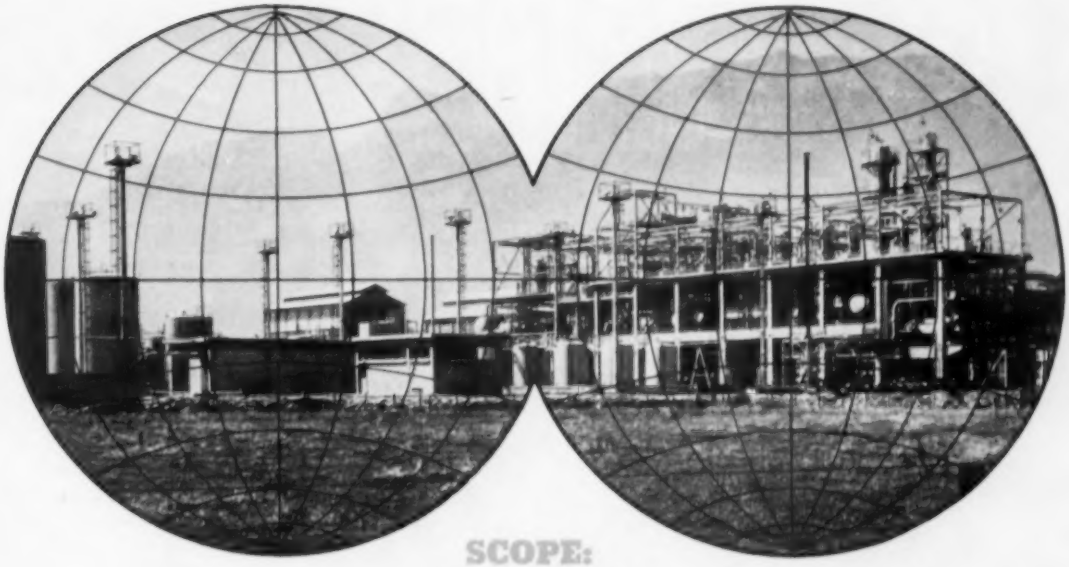
. . . **Brightest spot in the June market picture** was what the refiner ordinarily considers his most unwanted product—residual fuel. Increased coking operations in the Mid-Continent, a high rate of industrial demand generally, plus efforts of some eastern refiner-marketers to hold imports to the 1954 level (in line with recommendations of the President's Cabinet Fuels Policy Committee) combined to make heavy fuel the tightest item in the refined oils list.

In the Mid-Continent, No. 6 fuel was quoted at 10¢/bbl. higher, at $1.70, Group 3; and most refiners reported nearly sold-up positions. At the Gulf, low sulfur "C" fuel commanded premiums of as much as 25¢/bbl. over quotations or ordinary material.

. . . **In their search for domestic supplies** rather than to increase imports, East Coast marketers have now bought close to 4,000,000 bbl. of bunker oil from California refiners for delivery during the third quarter. But, some still see a "deficit" of about 6,000,000 bbl. if they are to meet estimated demand without increasing imports.

LUMMUS

DESIGNS, ENGINEERS AND CONSTRUCTS
PETROLEUM, CHEMICAL AND POWER PLANTS



SCOPE:
WORLD-WIDE

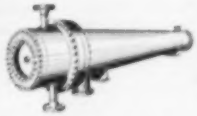
From Bombay, India to Beaumont, Texas, Lummus has supplied integrated control in designing, engineering and constructing over 700 major installations in the past half century. To make this possible, complete staffs are permanently maintained in principal cities on four continents. Supplementary activities include the manufacture of heat transfer equipment, oil heaters and fabricated piping.

Our staff and facilities can complement your own on your next project . . . location anywhere.
The Lummus Company, 385 Madison Avenue, New York 17, N. Y. *Engineering and Sales Offices:* New York, Houston, Montreal, London, Paris, The Hague, Bombay. *Sales Offices:* Chicago, Caracas. *Heat Exchanger Plant:* Honesdale, Pa. *Fabricated Piping Plant:* East Chicago, Ind.

ILLUSTRATED: PHENOL-ACETONE PLANT FOR
PROGIL-ELECTROCHIMIE AT PONT-DE-CLAIX, FRANCE

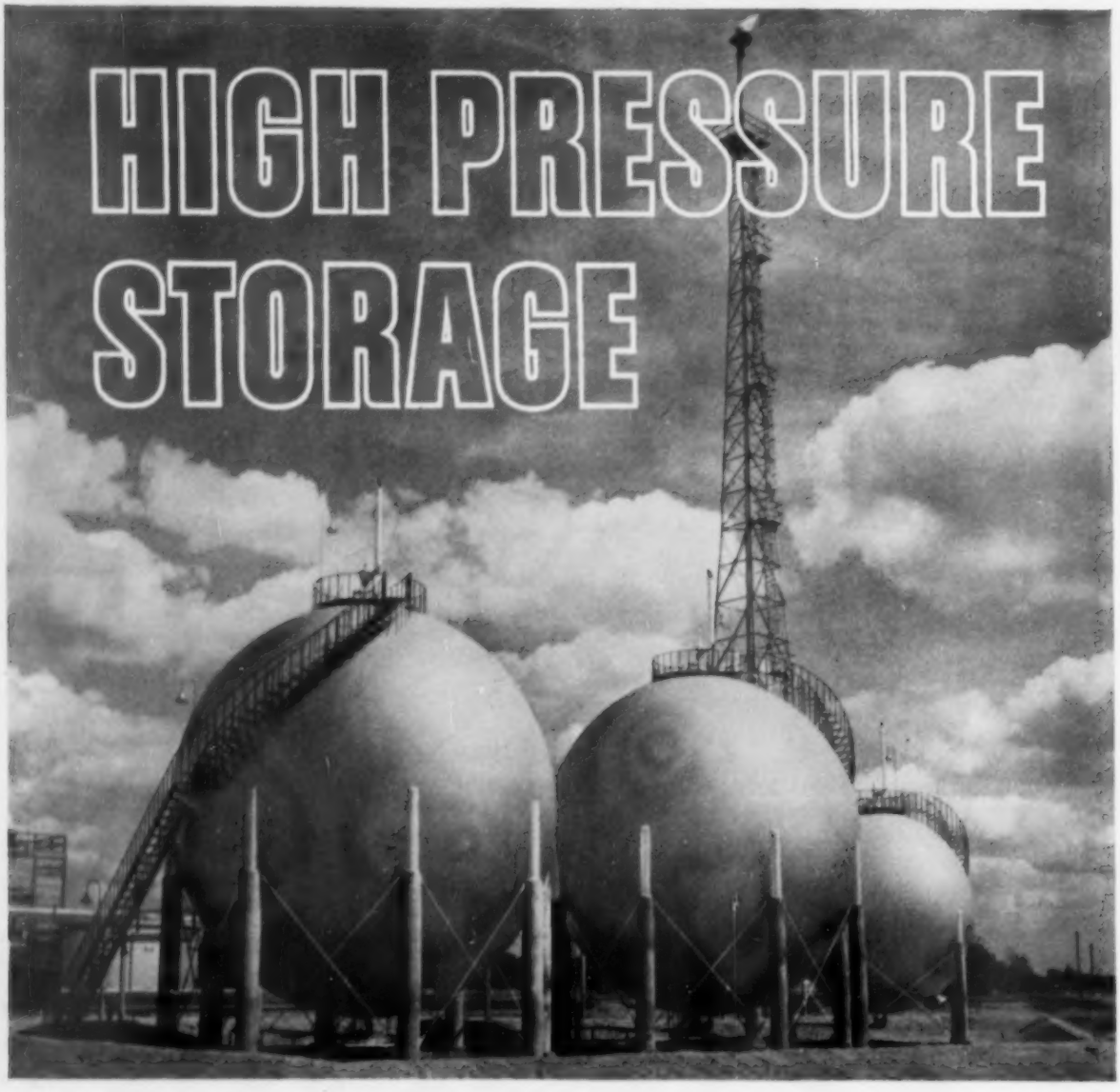
PLANT ENGINEERING
& CONSTRUCTION

OIL
HEATERS



HEAT TRANSFER
EQUIPMENT

FABRICATED
PIPING



GRAVERSPHERES

solve gas and liquid storage problems

For pressure storage of process butane, iso-butane, natural gasoline and other volatile liquids and gases, Graverspheres are a "natural."

Graverspheres are formed in Graver shops and are first carefully assembled to insure accurate fit. After this they are shipped to location, erected and field-welded.

These spheres—the very shape of which is ideal for high-pressure storage in quantity—are available in capacities from 1,000 to 30,000 bbl. For gas storage Graverspheres are made to withstand pressures up to 100 p.s.i.g. and for liquid storage from 20 to 90 lb. water pressure.

As is the case with Graver tanks, towers and pressure vessels, traditional Graver quality and craftsmanship are inherent in Graverspheres.

GRAVER TANK & MFG. CO., INC.
EAST CHICAGO, INDIANA

CHICAGO • NEW YORK • PHILADELPHIA • EDGE MOOR, DEL.
CATASAUQUA, PA. • PITTSBURGH • CLEVELAND • DETROIT • TULSA
SAND SPRINGS, OKLA. • HOUSTON • ODESSA, TEXAS • CASPER, WYO.
LOS ANGELES • FONTANA, CAL. • SAN FRANCISCO

GRAVER builds tanks, towers and pressure vessels for the chemical and petroleum industries

Low-Pressure Process Shifts and Boosts the Polyethylene Outlook

RECENTLY announced low-pressure methods for making polyethylene—several hundred psi versus the present method using up to 30,000 psi—are more than just a process improvement.

Low-pressure polymers are almost a separate family of plastics and probably will not be primary competition for conventional polyethylenes. Rather, the higher density, molecular weight, rigidity and softening points make the low-pressure polymer a more likely competitor for plastics such as impact styrene.

With properties so greatly different and costs about the same or lower than conventional polyethylene, the new low-pressure promises to open a whole new field of petrochemical activities and applications.

DuPont—latest company to announce plans for a low-pressure polyethylene pilot plant—will use the patents pioneered in Germany by Karl Ziegler, will call their product "Alathon." Other companies actively engaged in the use of the Ziegler process include Carbide and Carbon in a pilot plant at So. Charleston, W. Va., and Koppers at their Port Arthur, Texas plant. Others having an interest in the Ziegler method are Dow Chemical and Goodrich-Gulf, with Hercules and Monsanto reported to possess rights to the process but refusing to confirm or deny the reports.

Another low-pressure process has been developed by Phillips and is said to call for pressures of at least 100-300 psi and preferably about 500 psi, as compared to the reported process pressures of 10 to 2000 atmospheres for the Ziegler process.

Low-pressure polymers have high densities in the range from 0.93 to 0.95 (for Koppers' "Super Dylan") up to 0.96 (Phillips "Marlex 50") as compared to a maximum density of 0.923 for conventional polyethylene.

A direct result of the high density, "linear" characteristics (having a comparatively unbranched structure) of low-pressure polymer is an appreciable increase in softening points up to 260° F. as compared to a maximum of 235° F. for conventional polyethylenes. Tensile strengths for the low-pressure polymer range from 2,800 to 5,100 psi, versus 1000 to 1700 psi for conventional polyethylene.

Marked rigidity and a highly crystalline nature are the principal outward features of the low-pressure polymer. Most Ziegler polyethylene to date has been slightly off color—a defect which producers feel can be eliminated by more careful process control.

Applications are not yet ready for the new low-pressure polymer. However, anticipated uses include toys, kitchen ware, battery cases, radio housings, steering wheels, refrigerator parts, washing machine agitators, etc. as well as such traditional polyethylene uses as bottles, carboys, pipe and fittings.

Producers will be doing application research, but there is widespread optimism in the industry that once the dense polyethylenes appear on the market in force, potential customers will be suggesting plenty of uses—as was the case for conventional low density polyethylene.[1]

One fertile territory somewhat neglected by polyethylene producers is the medium density range between 0.923 (highest for conventional polyethylene) and 0.96 or 0.97 (upper range of linear materials). Koppers' new entries—with densities of 0.93 to 0.95—are the only polymers in this range.

Middle density polyethylene may open yet another field for the polymer. A team of Dupont workers is attempting to develop the correlation for the master pattern linking polyethylene's structural features to physical and chemical properties. If successful, this correlation may be used to design a polymer of desired properties, not only extending the useful range of applications for polyethylene, but even more important—pointing the way to the "tailor-making" of a vast number of other plastics. —R.L.D.

[1] "Filling in the Polyethylene Spectrum." *Chemical Week*, pp 58-62, June 4, 1955.

Can Today's Operations Gain From the 'New Kind of Engineer'?

YOU can expect to find specimens of a slightly different sort of engineer among your company's new recruits from now on. According to one source[1] the difference reflects a trend in engineering education, which, if it continues to grow, will result in a "new kind of engineer" being turned out at the bachelor's degree level by American colleges.

The change amounts to a turning away from specialization and toward a more intensive education in the basic sciences and engineering sciences. Specifically, there will be more mathematics, physics and chemistry, and more of such subjects as mechanics of solids and fluids, thermodynamics, and electrical theory. The student will learn correspondingly less about engineering practice in a specialized field, less about administration, and spend fewer hours in work with specific equipment.

The most ambitious ground-breaking has been done by Massachusetts Institute of Technology, where the first crop of a new version of electrical engineer was graduated in June. Although such traditional courses as those in alternating and direct current machinery were eliminated in favor of more basic material, the students gained in flexibility what they lost in the kind of knowledge that can be put to immediate use in industry. At least this is the view of MIT's Prof. Gordon S. Brown, who conceived the new curriculum.

Case Institute of Technology, Penn State University and the University of Michigan have similar moves in progress, though none of such sweeping character.

A large group of educators support this trend to a revamped engineering education. Their opinions are embodied in a report by a committee of 45 deans of engineering schools which was submitted in June to the American Society for Engineering Education. Though unrelated to the specific experiments of the

more adventurous engineering schools, the report echoes their thinking in its recommendation that engineering colleges cut down, at the undergraduate level, courses "having a high vocational or skill content and those primarily attempting to convey engineering art or practice."

The deans consulted faculty committees of over 100 engineering colleges to make their report. And they considered the views of representatives of the great majority of engineer-employing industry. So the report carries impressive credentials.

The ASEE recommends a curriculum broken down as follows: about half the student's time for mathematics, chemistry, physics and the engineering sciences; one-fifth to the humanities and social studies; and about one quarter to engineering analysis and design.

Furthermore, instruction in the last group of subjects should be made to count for more, the report asserts. Instead of a merely descriptive course on internal combustion engines, for instance, the instructor could draw on the principles and advanced analytical techniques of the engineering sciences and make it a more vital experience.

How will the new-style engineer go over in the oil industry? It's too early to be sure, but it's hard to see how his flexibility (if it turns out as predicted) could be anything but a blessing in the refinery, where the assignments are so varied. And a fast-changing industry should profit from an influx of men with a clearer view of the unchanging foundations.—S.D.B.

(1) "A New Kind of Engineer," *Business Week*, May 21, 1955, pp. 64-66.

Putting a Finger on the Elusive Physical Losses in Processing

SINCE actual material losses in petroleum processing operations are mostly in forms not easily discernible to the eye, they have too often been complacently accepted in the past as inherent to processing operations. Where an attempt was made to estimate the loss, it was done by taking the simple difference between crude runs and the quantity of products, after correcting for inventory changes. The refinery yield statement was the basis for the procedure.

Where processing is complex, as is the general rule today, "the general refinery yield statement is as antiquated for loss control purposes as are the refining processes for which it was originally designed," is the opinion of the Coordinator of Oil Loss Prevention for Esso Standard Oil Co.(1) "The result is that the so-called 'loss' from the yield statement bears no relationship to the real plant loss in a modern refinery."

In Esso's development work on loss control, serious consideration was given to the use of weight balances. At the same time, a procedure was developed which used the yield statement to the maximum possible extent by making the necessary compensations for the state and density changes in the processing operations. This involved developing correlations, and evaluating the effect of all major variables on the total recovery of each process, so that an anticipated recovery could be determined. This would take into account the effect of changes in operation on the volume (liquids) and weight (gas and solid products) yields.

Changes were made in the yield accounting methods to assure a common basis of calculation, and to permit a direct comparison between the total refinery recovery and the calculated anticipated recovery.

The difference between these two values was found to be representative of the true refinery loss. Many checks between losses determined by this procedure and those determined by a weight balance—when such a balance is done carefully and precisely—have indicated that the anticipated recovery procedure can be used with accuracy, provided the calculations are made carefully and the physical determinations and measurements are accurate.

"Since the 'anticipated recovery' calculated for each of the various operations is based upon 100% weight balance (no loss), there is no allowance for 'normal' processing losses in the calculation," the Esso report continues. "For this reason, the total refinery loss can be determined as the difference between the total refinery yield on the accounting statement and the 'anticipated' recovery."

An example to illustrate this principle is given in the report:

"Let us consider a plant processing crude by simple separation methods at the rate of 50,000 b/d. According to the yield statement, the recovery is 98% by volume (liquid products), and 1.5% by weight (gaseous and solid products), or a total recovery of 99.5%. The 'apparent' loss is 0.5%, equivalent to about 250 b/d.

"However, if operations include thermal cracking of 25,000 b/d of gas oil and reduced crude, at an average anticipated volume plus weight yield of 102%, the anticipated recovery, neglecting fine adjustments, would be calculated as follows: $100\% + (25{,}000/50{,}000) \times 102\% - 100.0\% = 101.0\%$.

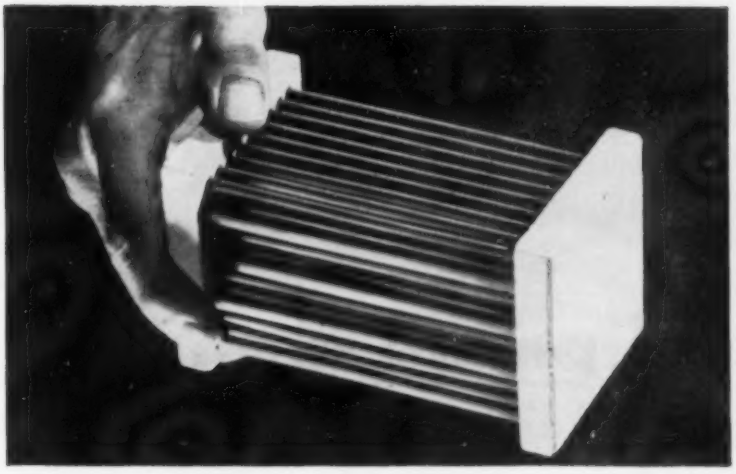
"In this case, the real refinery loss is 101% minus 99.5%, which is equivalent to 1.5%, or 750 b/d, rather than the apparent 0.5%, or 250 b/d."

With the Esso company, it was emphasized, recognition of the real physical losses in refining has been the economic incentive for improving loss control.

Like many other sources of economic loss in petroleum processing operations, for example, corrosion, an essential first principle is recognition of the need for accurate accounting. Industry is rapidly realizing that it is far better to say: "Our losses last year were 'X' thousands of dollars," rather than to say: "Oh yes, we lose oil here and there and probably quite a few barrels, but we don't worry too much over it."

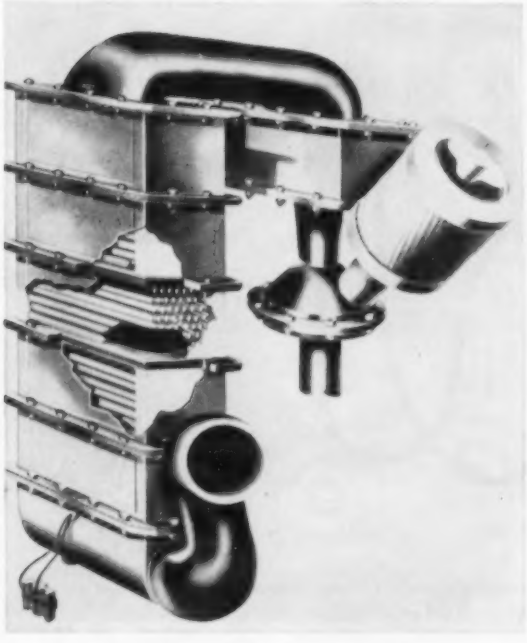
—V.B.G.

(1) "Loss Control in Transportation and Storage of Petroleum and Petroleum Products," by J. H. McClintock, Coordinator of Oil Loss Prevention, Esso Standard Oil Co., New York; presented at the Fourth World Petroleum Congress, Rome, Italy, June 6-15, 1955.



This new combustion catalyst, the oxycat, controls air pollution and creates energy and power by recovering waste heat. Porcelain rods (by Frenchtown Porcelain Company, Frenchtown, N.J.) are largely made of ALCOA Alumina to provide high resistance to thermal and mechanical shock. Rods are coated with a catalytic agent of ALCOA Activated Alumina and platinum.

In typical installations, oxycats are mounted in exhaust stacks of furnaces, drying ovens, incinerators, or any industrial processes where combustible gases are exhausted. Waste gases flow across rods. Combustion occurs at catalytic surface. Heat released by this exothermic reaction can be returned to the oven, converted to steam or used in other processes. Catalyst removes practically 100% of pollutants from gas streams.



Oxy-Catalyst catalytic exhaust, working on the same principle, ends dangerous exhaust fumes and odors from internal combustion engines. Made to take the place of standard mufflers, OCM is easily installed in gasoline, diesel or LPG-powered equipment.

Now ALCOA ALUMINA turns exhaust gases into energy instead of smog

Oxy-Catalyst, Inc. of Wayne, Pa., has put ALCOA Alumina to work eliminating air pollution and inefficient combustion, all in one operation.

In their new oxycat and OCM exhausts, ALCOA Alumina is part of the porcelain rods and catalytic coating. Used in the porcelain because it is highly inert and chemically stable, ALCOA Alumina does not interfere with the chemical reaction of the catalyst. In the coating, ALCOA® Activated Alumina provides extremely active oxidation maintained over a wide range of temperatures. It is very resistant to poisoning and highly efficient over a long period of time.

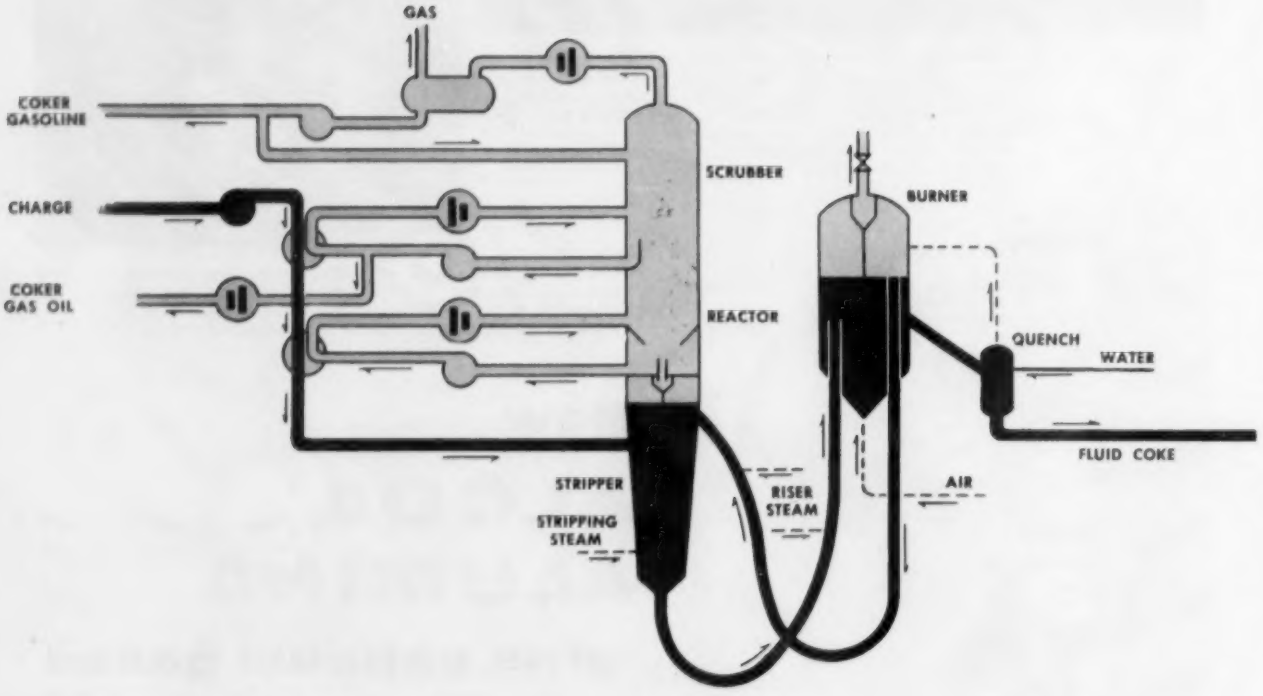
ALCOA Aluminas are remarkably versatile wherever they are used . . . with hundreds of applications in catalysis, desiccation, refractories and ceramics. Put ALCOA Aluminas to work *for you*. Write for samples of alumina to ALUMINUM COMPANY OF AMERICA, CHEMICALS DIVISION, 716-G Alcoa Building, Mellon Square, Pittsburgh 19, Pennsylvania.

ALCOA CHEMICALS
ALUMINUM COMPANY OF AMERICA

(To obtain more data on advertised products see page 1056)

fluid

its production...



IN THIS latest application of the fluidized-solids technique, developed by Esso Research and Engineering, heavy residua and asphalts can be converted to gas, oil and coke.

As shown in the flow diagram above, finely divided coke particles flow between two vessels—a burner and a reactor. In the burner, part of the coke stream is burned to supply the heats for vaporization, cracking and losses. When this hot coke meets the feed in the reactor, coking results and the liquid products are flashed off.

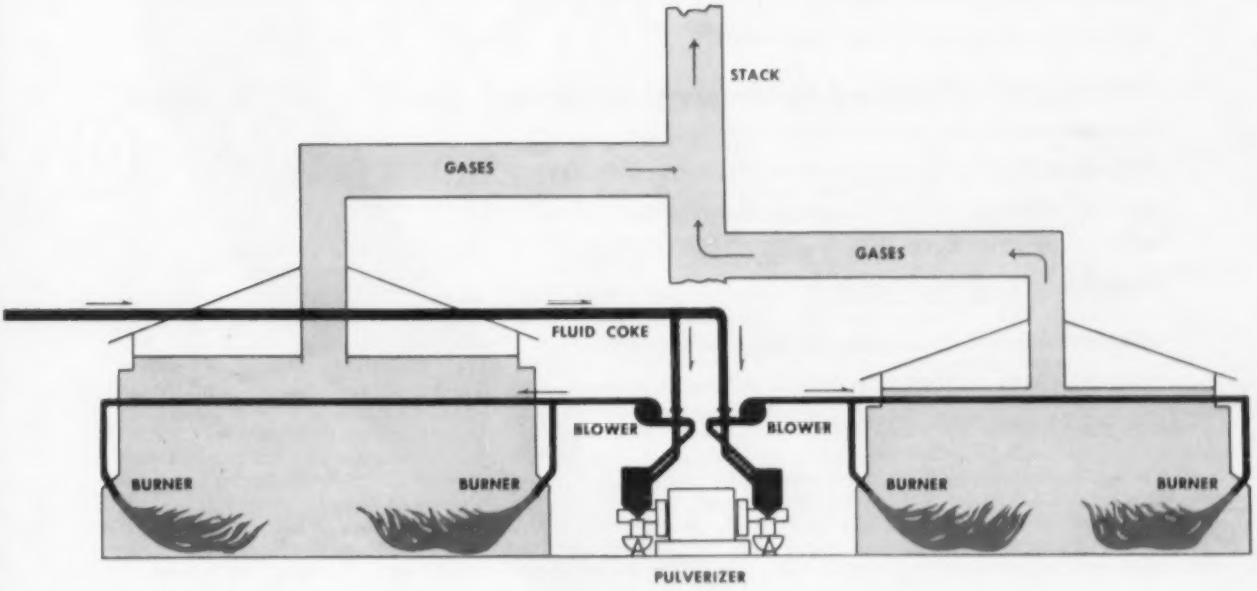
Coke particle size ranges between 75 and 150 microns and the coke itself is a clean, dustless solid. The feed is preheated through two fractionator (scrubber) pump-around systems. In the reactor it contacts the hot coke flowing from the burner. Coke is formed as the fluidized bed moves down into the stripper section where steam removes any remaining volatiles. The stripped coke then flows into the burner where, in contact with air, approximately 5 per cent by weight of the charge is burned. The coke inventory in the unit is fixed and the excess is removed as product coke which is cooled by water spray before flowing to storage.

The vapors from the reactor pass into the scrubber-fractionator section where they are separated into gas, gasoline and gas oil.

FOSTER

coke

...and utilization



THE USE of fluid coke as a fuel is illustrated in the above simplified diagram of two heaters designed by Foster Wheeler for a large oil company. They will supply the heat requirements for the atmospheric and vacuum sections of the highest capacity crude distillation unit in the world, having a combined heat absorption capacity of 336,400,000 btu per hour.

The pulverizers which reduce the particle size of the fluid coke before it is burned in the furnaces, as well as the pulverized coke burners, are also of Foster Wheeler design.

Designs are also available for the burning of fluid coke in steam generators.

Foster Wheeler's experience in the design of equipment for both the *production* and *utilization* of fluid coke will be of value to any process plant interested in converting heavy residua into cracking stock and making effective use of the resulting solid fuel. For further details on this process, or for proposals to meet your specific requirements, write to *Foster Wheeler Corporation, 165 Broadway, New York 6, N. Y.*

FW WHEELER

LONDON
NEW YORK
PARIS
ST. CATHARINES, ONT.

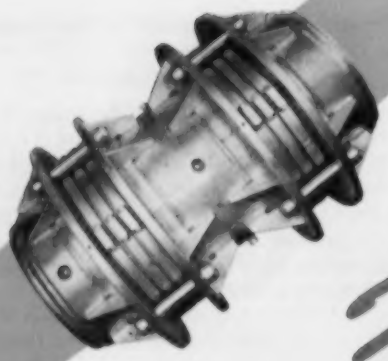
(To obtain more data on advertised products see page 1056)

LOOKING FOR AN "ALL PURPOSE" EXPANSION JOINT?

Zallea has never built one—never will. And for good reason. Like all precision engineered equipment, Zallea Expansion Joints are designed to fill specific rigid requirements. In every case, types, sizes and materials of construction are determined by factors of temperature, pressure, traverse and special service conditions.

Zallea Brothers design and build expansion joints for every requirement of modern industry. Field tests have proved the value of our emphasis on designing the expansion joint to fit the problem. Records show that Zallea Expansion Joints outlast all other packless expansion joints from 90% to as much as 1200%. Such reliability is further proof of Zallea design superiority.

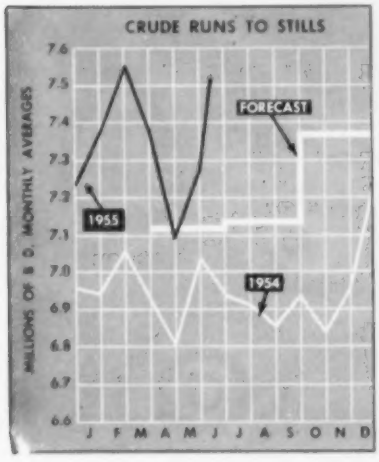
Zallea representatives are always ready to help solve problems relating to expansion joints. Or if you prefer, write for Bulletin 351 which describes the many standard types available.

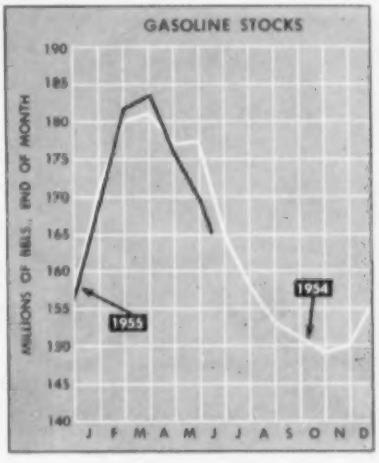


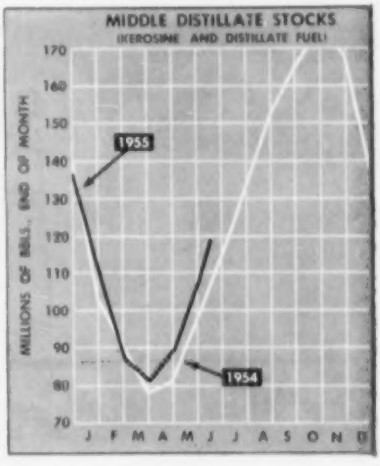
Zallea expansion joints

ZALLEA BROTHERS, 822 LOCUST STREET, WILMINGTON 99, DELAWARE

World's Largest Manufacturers of Expansion Joints







1955 figures to June 17

High Runs Piling Up Distillate Stocks

OUTLOOK: Gasoline inventory reductions will slow down in third quarter due to continued high rate of refinery output.

HEAVY, but seasonal, gasoline demand is currently pacing the rate of refinery operations and the result is already noticeable in a faster buildup of middle distillate inventories over those last year.

Crude runs for four weeks to June 17 have been almost 8% higher than for the corresponding weeks in 1954, while for the first five months they were 5.4% larger. Overall product demand is larger than had been anticipated, but even with the high third quarter gasoline shipments from refineries, overall demand will hardly be up 8% over last year. Total demand for the four volume products (gasoline, kerosine, distillate fuel oil and residuals) in the first 6 months was 6.1% higher than in the first half of 1954; gasoline demand 6.6% greater.

U. S. gasoline inventories June 17 were 165,285,000 bbls., about 3,900,000 bbls. (2.3%) less than a year ago. East of California stocks of 143,889,000 bbls. were about 4,000,000 bbls. (2.6%) less. From the high point of April 1, U. S. inventories have been reduced nearly 20,000,000 bbls., compared with withdrawals of about 10,700,000 bbls. in the same period in 1954. However, the past four weeks of high crude runs, May 20-June 17, have slowed down the rate of withdrawals, the total for the U. S. being around 5,400,000 bbls., as compared with over 5,500,000 bbls. in the same weeks in 1954. Stocks in the inland refining districts are 8.3% less than a year ago; in the combined East and Gulf Coast areas 4.3% greater.

U. S. middle distillate inventories (distillate fuel oil and kerosine combined) June 17, were about 119,704,000 bbls., about 13% higher than June 18, 1954. The relative rate of buildup this year has been larger during the last few weeks of stepped up crude runs.

The continuing demand for residual fuel oil is holding back the seasonal buildup of these inventories. Total for the U. S. June 17, 45,684,000 bbls., is 3,000,000 bbls. less than a year ago.

KEY STATISTICS

(Figures given in terms of millions of b/d, monthly averages, except stocks, which are in millions of bbls. at end of month)

	June 1955*	May 1955	June 1954
CRUDE OIL			
U. S. Production	6.609	6.664	6.500
Imports	.768	.746	.624
U. S. Stocks	275.768	280.337	285.155
Runs to Stills	7.529	7.276	6.947
GASOLINE			
Refinery Output	3.660	3.498	3.379
Refinery Demand	3.977	3.830	3.894
Primary Stocks	165.285	169.151	165.404
MIDDLE DISTILLATES			
Refinery Output	1.926	1.818	1.705
Refinery Demand	1.263	1.198	1.159
Primary Stocks	119.704	108.436	114.509
RESIDUALS			
Refinery Output	1.144	1.116	1.123
Imports	.329	.343	.318
Total Supply	1.473	1.459	1.441
Refinery Demand	1.390	1.444	1.349
Primary Stocks	45.684	44.272	50.216

*Through June 17.

PRODUCT AND CRUDE PRICES

Products—¢ gal., weighted average prices in principal refinery markets
Crudes—$/bbl., principal fields
Source—Platt's Oilgram Price Service

	June 1955*	May 1955	June 1954
Gasoline	11.35	11.33	11.64
Distillate Fuel Oil	9.01	9.11	8.93
Kerosine	10.49	10.51	10.33
Residuals	4.44	4.35	3.80
Above 4 Products	8.88	8.86	8.82
Lube Oils	16.83	16.83	16.70
Crude	2.82	2.82	2.81

REFINERY YIELDS

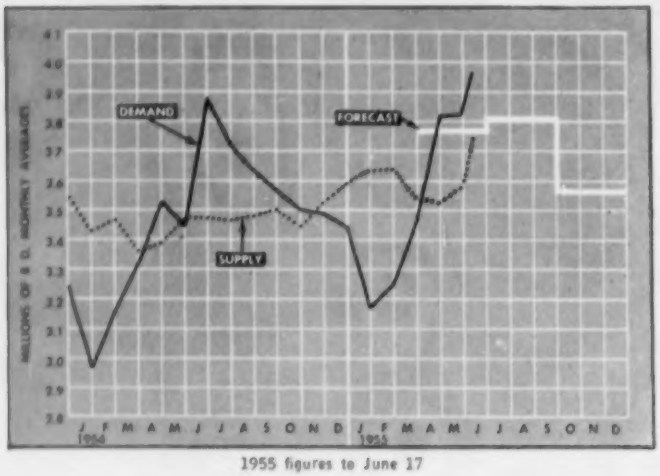
% on Crude Runs to Stills

	June 1955*	May 1955	June 1954
Gasoline	44.1	43.5	44.0
Kerosine	3.7	4.2	4.4
Distillate	21.9	20.8	20.1
Residuals	15.2	15.3	16.1

*Through June 17.

SOURCE OF DATA (except prices): Apr., May and June, API weekly reports; earlier months, Bureau of Mines

Motor Fuel Supply Is Keeping Pace With Demand

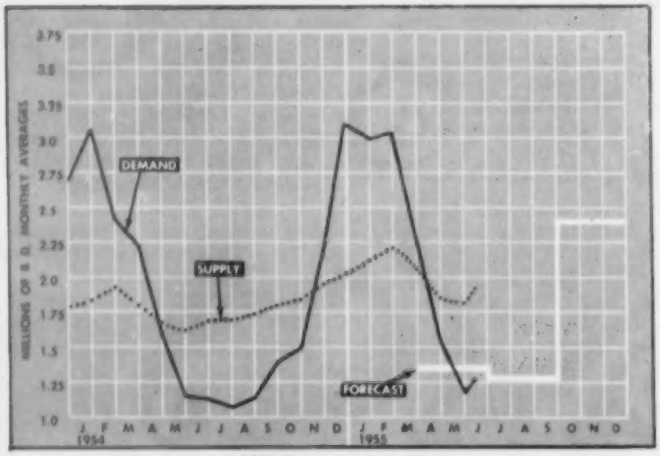


1955 figures to June 17

MOTOR FUELS

	From Crude	From Nat. Gas	Total
SUPPLY (Millions of b/d)			
May '55	3.166	.430	3.596
May '54	3.072	.410	3.482
Change	+.094	+.020	+.114
% Change	+3.1	+4.9	+3.3
DEMAND (including Exports) (Millions of b/d)			
May '55			3.830
May '54			3.463
Change			+.367
% Change			+10.3
TOTAL SUPPLY (Millions of bbls.)			
5 Mos. '55	477.856	64.168	542.024
5 Mos. '54	456.746	61.641	518.387
Change	+21.110	+2.527	+23.637
% Change	+4.6	+4.1	+4.6
TOTAL DEMAND (including Exports) (Millions of bbls.)			
5 Mos. '55			531.657
5 Mos. '54			498.661
Change			+32.996
% Change			+6.6

High Crude Runs Boost Summer Distillate Output

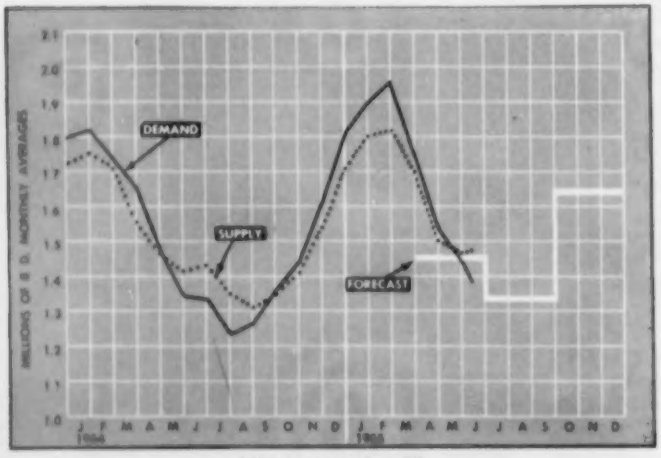


1955 figures to June 17

MIDDLE DISTILLATES

	Kerosine	Dist. Fuel Oil	Total
PRODUCTION (Millions of b/d)			
May '55	.304	1.514	1.818
May '54	.302	1.372	1.674
Change	+.002	+.142	+.144
% Change	+0.7	+10.3	+8.6
DEMAND (including Exports) (Millions of b/d)			
May '55	.153	1.045	1.198
May '54	.165	1.004	1.169
Change	—.012	+.041	+.029
% Change	—7.3	+4.1	+2.5
TOTAL PRODUCTION (Millions of bbls.)			
5 Mos. '55	53.119	250.555	303.674
5 Mos. '54	53.586	217.683	271.269
Change	—.467	+32.872	+32.405
% Change	—0.9	+15.1	+11.9
TOTAL DEMAND (including Exports) (Millions of bbls.)			
5 Mos. '55	55.589	277.444	333.033
5 Mos. '54	58.378	258.296	316.674
Change	—2.789	+19.148	+16.359
% Change	—4.8	+7.4	+5.2

Good Off-Season Demand for Residual Fuel Oil



1955 figures to June 17

RESIDUAL FUELS

	Refinery Output	Imports	Total
SUPPLY (Millions of b/d)			
May '55	1.116	.343	1.459
May '54	1.148	.276	1.424
Change	—.032	+.067	+.035
% Change	—2.8	+24.3	+2.5
DEMAND (including Exports) (Millions of b/d)			
May '55			1.444
May '54			1.356
Change			+.088
% Change			+6.5
TOTAL SUPPLY (Millions of bbls.)			
5 Mos. '55	178.547	71.501	250.048
5 Mos. '54	180.171	59.245	239.416
Change	—1.624	+12.256	+10.632
% Change	—0.9	+20.7	+4.4
TOTAL DEMAND (including Exports) (Millions of bbls.)			
5 Mos. '55			259.046
5 Mos. '54			244.153
Change			+14.893
% Change			+6.1

SOURCE OF DATA: Apr., May and June, API weekly reports; earlier months, Bureau of Mines

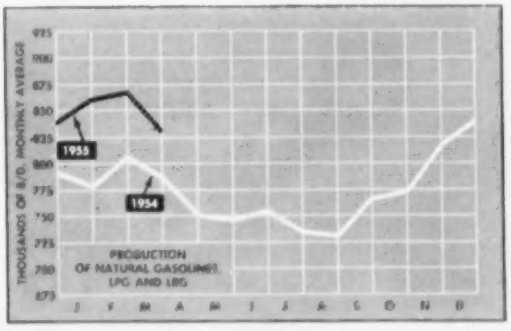
RUNS TO STILLS AND DISTRIBUTION OF PRIMARY STOCKS BY U. S. REFINERY DISTRICTS

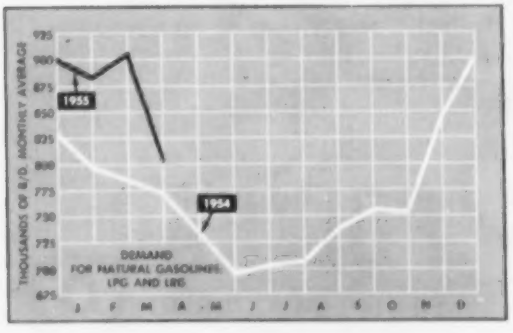
(Primary stocks include those at refineries, at large terminals and in pipelines; all data based on API reports)

District	RUNS TO STILLS (Millions of b/d average for week ending on date shown) June 17 1955	June 18 1954	Change	% Change	GASOLINE STOCKS (Millions of bbls. on date shown) June 17 1955	June 18 1954	Change	% Change	RESIDUAL STOCKS (Millions of bbls. on date shown) June 17 1955	June 18 1954	Change	% Change
East Coast	1.047	1.039	+ .008	+ 0.8	36.955	37.212	— .257	— 0.7	9.766	9.359	+ .407	+ 4.3
Gulf Coast	2.535	2.178	+ .357	+16.4	32.581	29.471	+3.110	+10.6	5.976	5.790	+ .186	+ 3.2
Total Coastal	3.582	3.217	+ .365	+11.3	69.536	66.683	+2.853	+ 4.3	15.742	15.149	+ .593	+ 3.9
Appalachian	.191	.204	— .013	— 6.4	6.564	7.146	— .582	— 8.1	.578	.863	— .285	—33.0
Ind.-Ill.-Ky.	1.363	1.246	+ .117	+ 9.4	34.445	37.637	—3.192	— 8.5	4.394	4.447	— .053	— 1.2
Okla.-Kans.-Mo.	.720	.640	+ .080	+12.5	15.577	17.535	—1.958	—11.2	.888	1.338	— .450	—33.6
Other Inland	.643	.588	+ .055	+ 9.4	17.767	18.796	—1.029	— 5.5	2.241	2.351	— .110	— 4.7
Total Inland	2.917	2.678	+ .239	+ 8.9	74.353	81.114	—6.761	— 8.3	8.101	8.999	— .898	—10.0
Total East of Calif.	6.499	5.895	+ .604	+10.2	143.889	147.797	—3.908	— 2.6	23.843	24.148	— .305	— 1.3
California	1.021	.998	+ .023	+ 2.3	21.396	21.389	+ .007	0	21.841	24.872	— 3.031	—12.2
Total U. S.	7.520	6.893	+ .627	+ 9.1	165.285	169.186	—3.901	— 2.3	45.684	49.020	— 3.336	— 6.8

District	DISTILLATE FUEL OIL STOCKS (Millions of bbls. on date shown) June 17 1955	June 18 1954	Change	% Change	KEROSINE STOCKS (Millions of bbls. on date shown) June 17 1955	June 18 1954	Change	% Change	TOTAL MIDDLE DISTILLATE STOCKS (Millions of bbls. on date shown) June 17 1955	June 18 1954	Change	% Change
East Coast	29.574	26.952	+ 2.622	+ 9.7	11.627	10.668	+ .959	+ 9.0	41.201	37.620	+ 3.581	+ 9.5
Gulf Coast	15.987	11.617	+ 4.370	+37.6	5.735	5.447	+ .288	+ 5.3	21.722	17.064	+ 4.658	+27.3
Total Coastal	45.561	38.569	+ 6.992	+18.0	17.362	16.115	+1.247	+ 7.7	62.923	54.684	+ 8.239	+15.1
Appalachian	2.549	2.000	+ .549	+27.5	.894	.820	+ .074	+ 9.0	3.443	2.820	+ .623	+22.1
Ind.-Ill.-Ky.	17.412	14.901	+ 2.511	+16.9	6.542	5.758	+ .784	+13.6	23.954	20.659	+ 3.295	+15.9
Okla.-Kans.-Mo.	10.405	8.909	+ 1.496	+16.8	1.674	1.428	+ .246	+17.2	12.079	10.337	+ 1.742	+16.9
Other Inland	5.786	4.600	+ 1.186	+25.8	1.627	1.352	+ .275	+20.3	7.413	5.952	+ 1.461	+24.5
Total Inland	36.152	30.410	+ 5.742	+18.9	10.737	9.358	+1.379	+14.7	46.889	39.768	+ 7.121	+17.9
Total East of Calif.	81.713	68.979	+12.734	+18.5	28.099	25.473	+2.626	+10.3	109.812	94.452	+15.360	+16.3
California	9.556	11.175	— 1.619	—14.5	.336	.469	— .133	—28.4	9.892	11.644	— 1.752	—15.0
Total U. S.	91.269	80.154	+11.115	+13.9	28.435	25.942	+2.493	+ 9.6	119.704	106.096	+13.608	+12.8

Natural Gas and Refinery Gas Liquids





SUPPLY AND DEMAND STATISTICS

(Bureau of Mines Data)

CURRENT PRODUCTION (1000 b/d monthly average)	Mar. 1955	Feb. 1955	Mar. 1954
At Natural Gasoline and Cycling Plants			
Liquefied Petroleum Gas	361	390	332
Natural Gasoline and Isopentane	275	270	265
Condensate	21	23	30
Finished Gasoline, Naptha and Other	63	67	55
Total Natural Gasoline and Cycling Plant Production	720	750	682
Liquefied Refinery Gases	111	117	105
Total Marketable Gas Liquids	831	867	787
Lease Condensate	114	114	107
Total Natural Gas Liquids	945	981	894

CURRENT DEMAND (1000 b/d monthly average)			
LPG and LRG	452	548	418
Natural Gasoline, Isopentane and Other	349	360	353
Total Marketable Gas Liquids	801	908	771

CUMULATIVE PRODUCTION (1000 bbls.)	Mar. 1955	Mar. 1954
LPG and LRG	44,347	40,168
Natural Gasoline, Isopentane and Other	32,355	30,958
Total Marketable Gas Liquids	76,702	71,126

CUMULATIVE DEMAND (1000 bbls.)		
LPG and LRG	45,983	39,385
Natural Gasoline, Isopentane and Other	31,647	31,014
Total Marketable Gas Liquids	77,630	70,399

STOCKS (1000 bbls., end of month)	Mar. 1955	Feb. 1955	Mar. 1954
LPG and LRG	6,122	5,498	5,260
Natural Gasoline, Isopentane and Other	5,365	5,064	4,832
Total Stocks	11,487	10,562	10,092

WHY PAY FOR THIS?

Why pay for fouling when Polyrad costs so little? Frequent down time for cleaning or replacing fouled and corroded equipment is no longer a normal operating expense for refineries. Not when Polyrad corrosion inhibitor can prevent damage with an average treatment of about 1 quart of Polyrad per 1,000 barrels of fluid.

Polyrad's powerful detergent action loosens organic and inorganic deposits and permits their removal in the fluid stream. This means you can prevent fouling by using Polyrad—and you can even clean up fouled equipment by starting Polyrad treatment. All around the refinery, Polyrad helps maintain throughput, increases heat transfer, reduces metal loss, and cuts down time for maintenance.

Polyrad is readily available from stocks maintained throughout the country. A Hercules technical representative will be glad to assist in evaluating Polyrad under your own operating conditions.

Naval Stores Department
HERCULES POWDER COMPANY
INCORPORATED
984 King Street, Wilmington 99, Del.

POLYRAD®
FILMING AMINE INHIBITOR

NA55-2

DU PONT
REG. U.S. PAT. OFF.

PETROLEUM CHEMICALS DIVISION
NEWS

DU PONT
REG. U.S. PAT. OFF.

July ★ *One of a Series of Interest to the Petroleum Industry* ★ *1955*

NEW TECHNICAL BOOKLET ON GREASE ADDITIVES

Du Pont "Ortholeum" 300 and Phenyl-alpha-Naphthylamine have long been effectively used for stabilizing greases. In the past, however, there has been little information published on the properties, uses, methods of addition and evaluation of these additives.

This information is now available to grease compounders in a new four-page booklet. To get a copy, just ask one of our representatives or regional offices for "Stabilizers for Grease."

Many Du Pont Films Available to the Petroleum Industry

Over 40 different 16 mm. movies, covering a wide range of subjects are readily available to you through the Du Pont Petroleum Chemicals Division.

Many of them were specifically designed and produced to help the oil industry promote its products and do a more comprehensive public relations job. Most recent of these is entitled "When the customer says 'KNOCK.'" It will give your dealers a quick, clear visual education on how to answer knock complaints in a salesmanlike way. Other full-color Du Pont films of particular interest to the industry include "What Makes a Gasoline Good," and "Pipeline on Wheels," which shows the public how petroleum products tank trucks are designed and operated for maximum highway safety.

To provide extra entertainment at dealer meetings and other gatherings, a library of Du Pont "Cavalcade of America" TV films is also available on loan. This series includes a documentary film on the famous Spindletop well.

Ask any of our representatives for more details on obtaining these films for your own use.

The service station operator is your most important link with the market

THE SERVICE STATION OPERATOR is generally an independent sort of fellow by nature. And he has his own opinions about customer credit, promotion, price wars, handling employees, and many other important aspects of service station operation.

What does he *really* think . . . and how can this affect your marketing program? A new Du Pont survey can help you answer these questions.

HOW MUCH does the average service station operator know about the quality features of the products he sells? The new Du Pont dealer survey can give you a realistic, unbiased answer.

The results of the new survey—entitled "The Service Station Operator"—are to be published in a series of five reports. The first report is already off the press and is now being distributed to oil company marketing executives. The other four reports will be issued periodically during the next twelve months.

Impartial

Sponsored by Du Pont, the survey was conducted on a completely impartial basis by National Analysts, Inc. It is nationwide in scope and part of the continuing market research work of the Du Pont Petroleum Chemicals Division. It follows the recent Du Pont survey of service station customer buying habits.

To meet industry need

The survey was initiated because it was widely felt that the oil industry had a real need for more information about their dealers and dealer operations. The questionnaire itself was prepared after discussion with oil company market research groups and members of the Marketing Research Committee of the American Petroleum

ADVERTISEMENT—Prepared for the Petroleum Chemicals Division of E. I. du Pont de Nemours & Company (Inc.)

OVER

PETROLEUM CHEMICALS DIVISION
NEWS

CONTINUED *Dealer Survey*

Institute.

Using the scientifically accurate area sampling method, the survey consisted of personal interviews with 2,633 service station operators. This sample is representative of all the operators in the United States. But the results can be broken down and cross tabulated to give a true sample of any of four different regional divisions.

What was studied

The first report covers such factors as station hours and rush periods, gallonage sold, customer credit, and the use of customer mailing lists.

The second report, which will soon be ready for distribution, will discuss the dealer's knowledge of the products he sells, including his knowledge of additives and their functions. It also records dealer opinions of gasoline sales assets and knowledge of pricing.

Future reports

The third report will cover dealer-supplier relationships, opinions of dealer meetings, publications, and advertising. The fourth report covers the dealer's relationship with his employees, his own background, dealer associations, his income and method of paying his employees.

The fifth report will deal with the interrelationship of all the previously discussed factors . . . such as how station hours, dealer meetings and education affect sales volume. As such, it will be an extremely penetrating and significant report.

Available to marketers

This continuing survey work is done by Du Pont for the petroleum industry. And the findings are readily available to all oil companies. In addition to the regular distribution of reports to marketing executives, the entire survey has been tabulated on IBM cards which will give a wide variety of specialized breakdowns to meet the individual needs of various oil companies. For more information about this survey, just get in touch with any of our representatives or regional offices.

ASSISTANT MID-CONTINENT MANAGER

BARRETT B. RUSSELL is assistant manager of Du Pont Petroleum Chemicals Division's Mid-Continent Region with headquarters in Tulsa, Oklahoma.

Before joining the Du Pont Company in 1950, Mr. Russell was an engineer with the Standard Oil Development Company. In this capacity he worked on catalytic cracking, jet fuels, gasoline blending, special lubricants and combustion studies both at Baton Rouge, Louisiana, and Linden, New Jersey.

At Du Pont, he has been Sales-Service Representative and Sales Supervisor in the Central Region and Technical Assistant to the Sales Manager in Wilmington.

A graduate of Massachusetts Institute of Technology with a B.S. degree in Chemical Engineering, Mr. Russell is a member of the American Petroleum Institute, Society of Automotive Engineers, and the American Chemical Society.

One simple word can spell bigger TBA profits for your dealers

More TBA items are bought from service stations than from any other source. Why? . . .

It may be pure luck . . . because the Du Pont survey, "The Service Station and the Motorist," shows that, in practically every case, the sale started with the customer's *requesting* an item — rather than any *selling* on the dealer's part.

SELLING, therefore, is the word . . . the key to increasing, or possibly even multiplying, TBA profits for your dealers.

To help you alert your dealers to the opportunities, stimulate them to do more TBA selling, we have just prepared a new booklet (No. 5) in the Du Pont "through the windshield" series. The title is "A look at the TBA buyer." The copy, based on market data collected for the Du Pont survey, "The Service Station and the Motorist," is simply written so that it will be easy for the average dealer to understand and remember.

Ask one of our representatives or regional offices for sample copies and cost information on obtaining these booklets in large quantities for your dealers.

DU PONT
REG. U.S. PAT. OFF.
Better Things for Better Living
. . . through Chemistry

Petroleum Chemicals

E. I. DU PONT DE NEMOURS & COMPANY (INC.)
Petroleum Chemicals Division • *Wilmington 98, Delaware*

Regional Offices:
NEW YORK, N. Y.—1270 Ave. of the Americas Phone COlumbus 5-2342
CHICAGO, ILL.—8 So. Michigan Ave. Phone RAndolph 6-8630
TULSA, OKLA.—P. O. Box 730 Phone LUther 5-5578
HOUSTON, TEXAS—705 Bank of Commerce Bldg. Phone CApitol 5-1151
LOS ANGELES, CALIF.—612 So. Flower St. Phone MAdison 5-1691

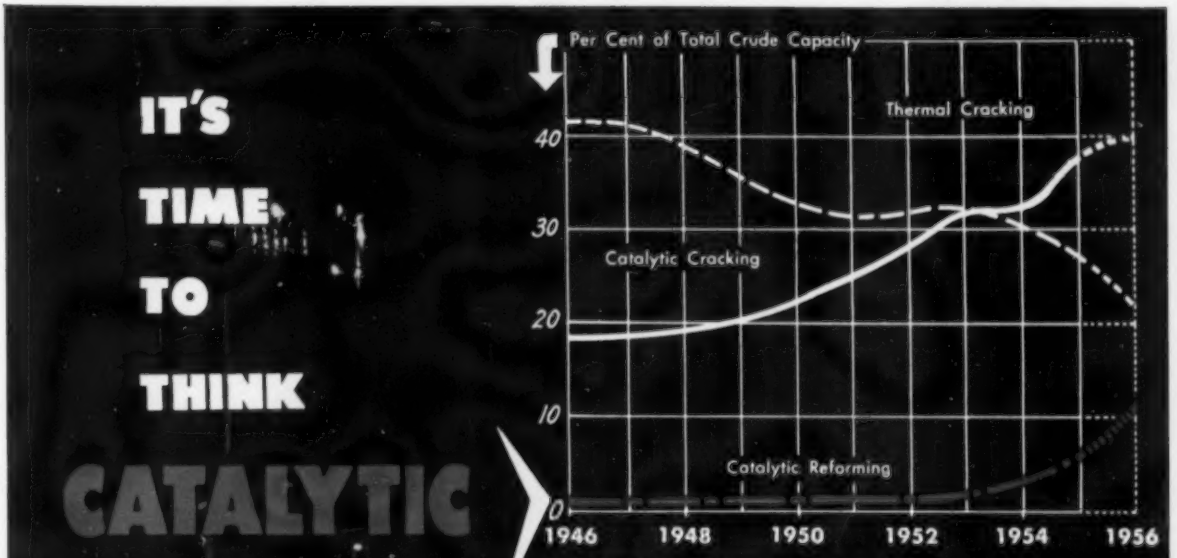
IN CANADA: Du Pont Company of Canada Limited—Petroleum Chemicals Division, 80 Richmond Street, West, Toronto 1, Ontario
OTHER COUNTRIES: Petroleum Chemicals Export—Nemours Bldg., 6539—Wilmington 98, Del.

ADVERTISEMENT—Prepared for the Petroleum Chemicals Division of E. I. du Pont de Nemours & Company (Inc.)

A-9615

Printed in U. S. A.

IT'S TIME TO THINK CATALYTIC



TRENDS IN CONVERSION CAPACITY

Related to total crude capacity

(Graph, Courtesy The Oil & Gas Journal)

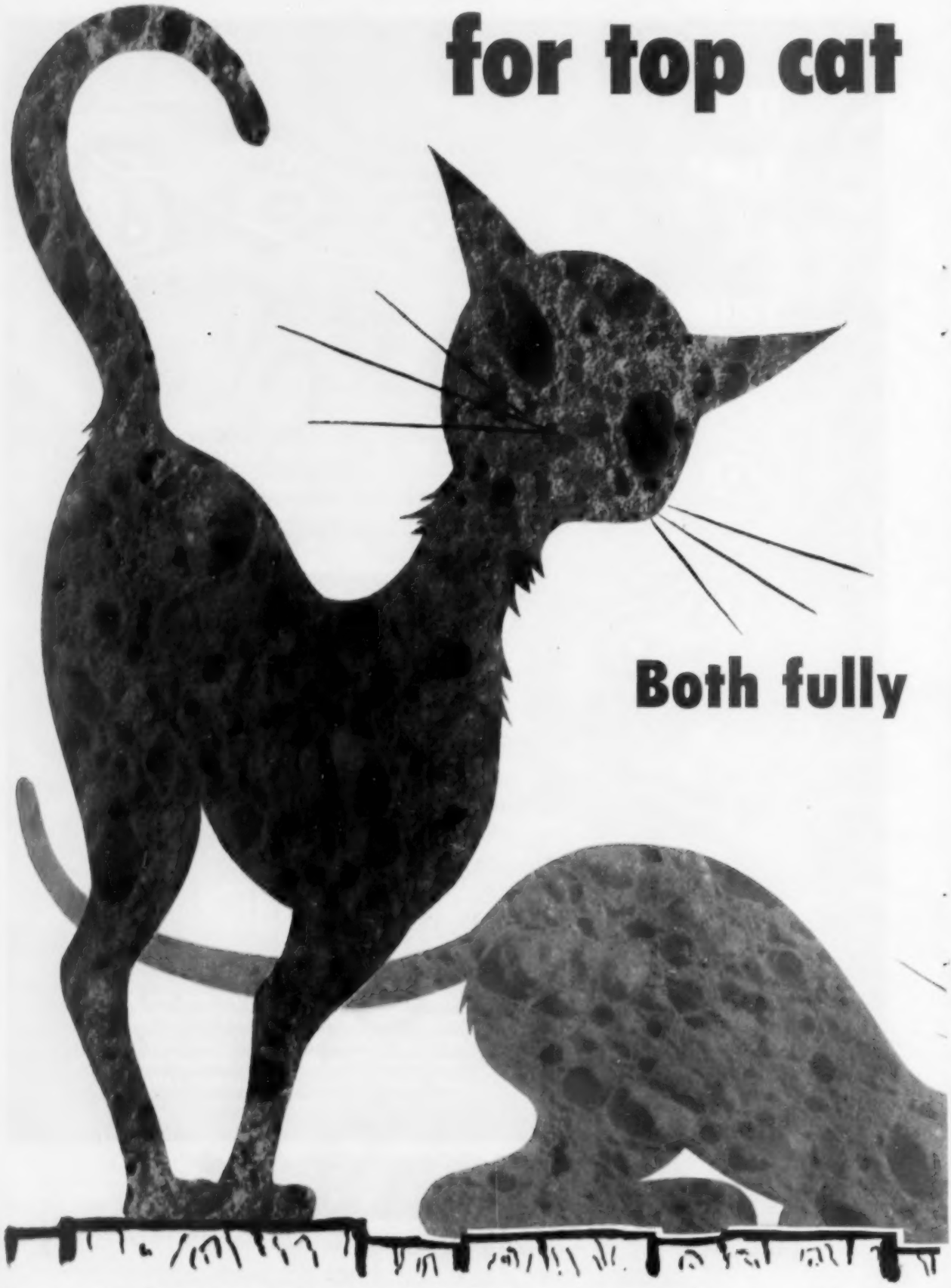
With the trend to higher octane and higher quality motor fuels you will have to appraise your refining facilities with an eye to keeping your plant in a highly competitive position. TRECO keeps abreast of the latest developments in the refining field; our staff has been expanded and we are regularly completing new facilities in record time.

Give us a call before you get into the planning stage. Our wide experience in all phases of refining enables us to show you how you can save money from the design through engineering and construction. A telephone call, wire or letter will get prompt attention.

TRECO

REFINERY ENGINEERING Company

TULSA TORONTO



(To obtain more data on advertised products see page 1056)

cracking efficiency...

...whatever your catalyst requirement

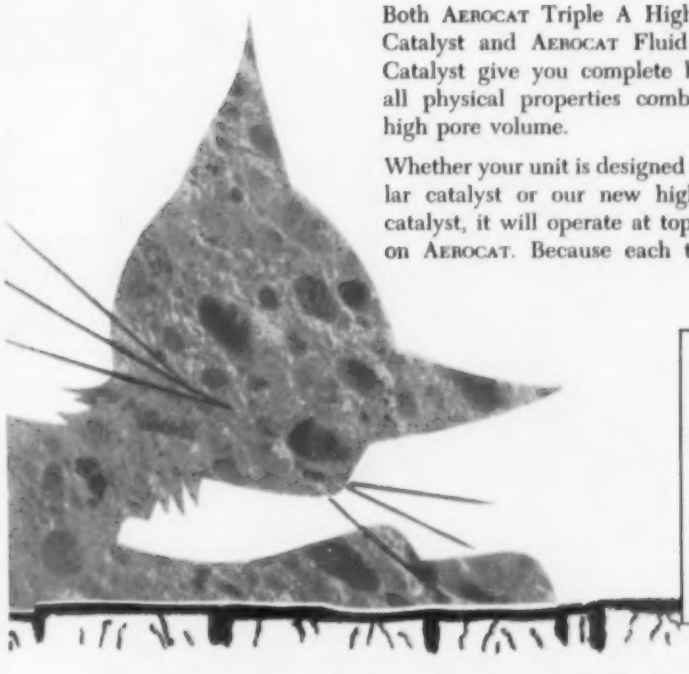
Aerocat Triple A*

High Alumina Catalyst

Aerocat®

Fluid Cracking Catalyst

balanced with High Pore Volume



Both AEROCAT Triple A High Alumina Catalyst and AEROCAT Fluid Cracking Catalyst give you complete balance of all physical properties combined with high pore volume.

Whether your unit is designed for a regular catalyst or our new high alumina catalyst, it will operate at top efficiency on AEROCAT. Because each type offers optimum balance of pore volume with pore diameter, particle shape, particle size distribution and hardness.

Remember Cyanamid was first to deliver a commercially successful high alumina catalyst, first to deliver high pore volume in balance with other catalyst properties. Ask your Cyanamid Representative about AEROCAT Catalyst with high **PV.**

*Trade-mark

AMERICAN *Cyanamid* COMPANY
REFINERY CHEMICALS DEPARTMENT
30 Rockefeller Plaza, New York 20, N.Y.

In Canada: North American Cyanamid Limited, Toronto and Montreal

(To obtain more data on advertised products see page 1056)

NEW Advanced Design...

NEW HIGH SUSTAINED ACCURACY . . .
even under extreme operating and ambient conditions

NEW CONVENIENT ZERO ADJUSTMENT . . .
external—no need to remove weather-proof cover

FACTORIES IN THE UNITED STATES, CANADA AND ENGLAND

d/p Cell Flow Transmitter...

NEW POSITIVE OVERRANGE PROTECTION . . . up to full 1500 lbs. cell rating

6 Major Achievements!

NEW FULLY ADJUSTABLE RANGE . . . from 0-50" to 0-250" H_2O differential

NEW AUTOMATIC INTERNAL DAMPING . . . fast, stable measurement

NEW SIMPLICITY . . . lowest cost installation

Pioneered by Foxboro 7 years ago, the d/p Cell* Transmitter established a new standard of performance in flow measurement and control. Over 40,000 are maintaining that standard in every branch of industry today. Technical advances, based on this unequalled experience, now have added even further reliability, economy and convenience. Call your Foxboro representative for a demonstration. Write for new Bulletin 13-11.

*Reg. U. S. Pat. Off.

FOXBORO
REG U S PAT OFF

first in flow measurement

THE FOXBORO COMPANY, 917 NEPONSET AVE., FOXBORO, MASS., U.S.A.

don't be left behind . . .

EVERY REFINER AND EVERY MARKETER REALIZES THE SIGNIFICANCE OF THE PRESENT TREND TO HIGHER OCTANES. It is a trend that predicts the future market demands for improved motor fuels to efficiently power higher compression automotive engines.

New methods . . . new techniques . . . new concepts in refining processes and equipment—all are necessary to adequately meet the refiner's needs in enabling him to produce a higher octane gasoline most efficiently and economically.

Cracking the octane barrier, Universal has provided Rexforming*—a process completely capable of solving the refining industry's most immediate and long-range problem.

In the final analysis, the refiner who can produce the products for which there is the greatest demand, and the marketer who can supply them will be building a sound economic position for the future.

Don't be left behind! Check

Rexforming

TRADE MARK

carefully . . . examine it in relation to your refining and marketing problems. Chances are that you will want to consider its immediate application to give you today's and tomorrow's octanes.

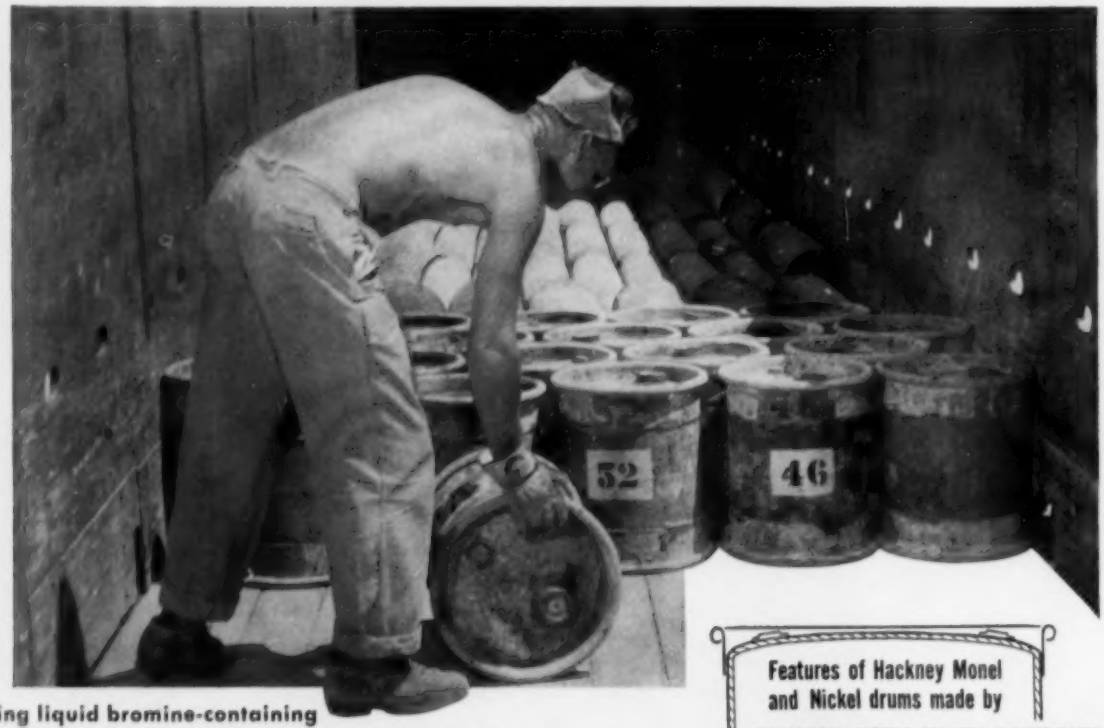
UNIVERSAL OIL PRODUCTS COMPANY

UOP

30 ALGONQUIN ROAD,
DES PLAINES, ILL., U. S. A.
Laboratories: RIVERSIDE, ILLINOIS

Universal Service
Protects Your Investment

Developed by the Pioneers of Platinum Catalyst Reforming



Loading liquid bromine-containing Monel drums into truck at a California plant. Ten gallon Monel drums are easily handled by one man, singly or on pallets.

The low-cost way to move corrosive chemicals and protect purity is to...

ship in Monel or Nickel Drums

One of the most troublesome things to ship economically is a few hundred gallons or so of a poisonous liquid corrosive or a purity-sensitive chemical. Ordinary shipping drums are out of the question. Glass bottles require too much individual handling. Lined drums may crack or peel under rough handling.

Here's how several industries solved this problem:

The makers and users of liquid bromine used to employ glass bottles or lead-lined drums. Both were unsatisfactory. The bottles needed careful packing, had excessive tare weights and, of course, broke easily.

Now they ship dry bromine in Monel drums . . . solid Monel drums like this Hackney drum. The Monel drums satisfactorily resist corrosion, weigh a third as much as the lined drums and a fifth as much as the case of glass bottles.

Manufacturers of corrosive phosphorus compounds formerly used 55-gallon lined drums that weighed 330 pounds empty. Now they use solid Nickel drums weighing 190 pounds less. Think what that saves in labor and freight.

A maker of benzyl chloride once had to add an inhibitor to his product before it could safely be shipped in iron drums—then remove it again. Now he ships in nickel drums and his product stays clear, colorless and free of contamination.

This type of container has also been found adaptable for many other chemical and food products, including those where purity is of primary concern.

What about cost?

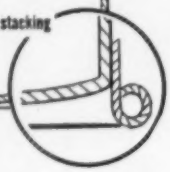
A Monel or nickel drum actually costs less than the heavy lined containers. However, even where the initial cost is higher, the long life and greater durability of the nickel alloy container usually reduces the per-trip cost below that of other types. And having the product arrive in a non-breakable, purity-protecting container reduces the problem of customer complaints.

For exact prices, ICC specifications and information on suitable applications of Monel and Nickel drums, write The Pressed Steel Tank Company, 1447 South 6th Street, Milwaukee, Wisconsin.

Features of Hackney Monel and Nickel drums made by

PRESSED STEEL TANK COMPANY

1. Top and bottom halves of drum formed as single pieces.
2. High strength circumferential welded center seam.
3. Seamless chimes eliminate corrosion-breeding crevices.
4. Shock absorbing foot and stacking rings.

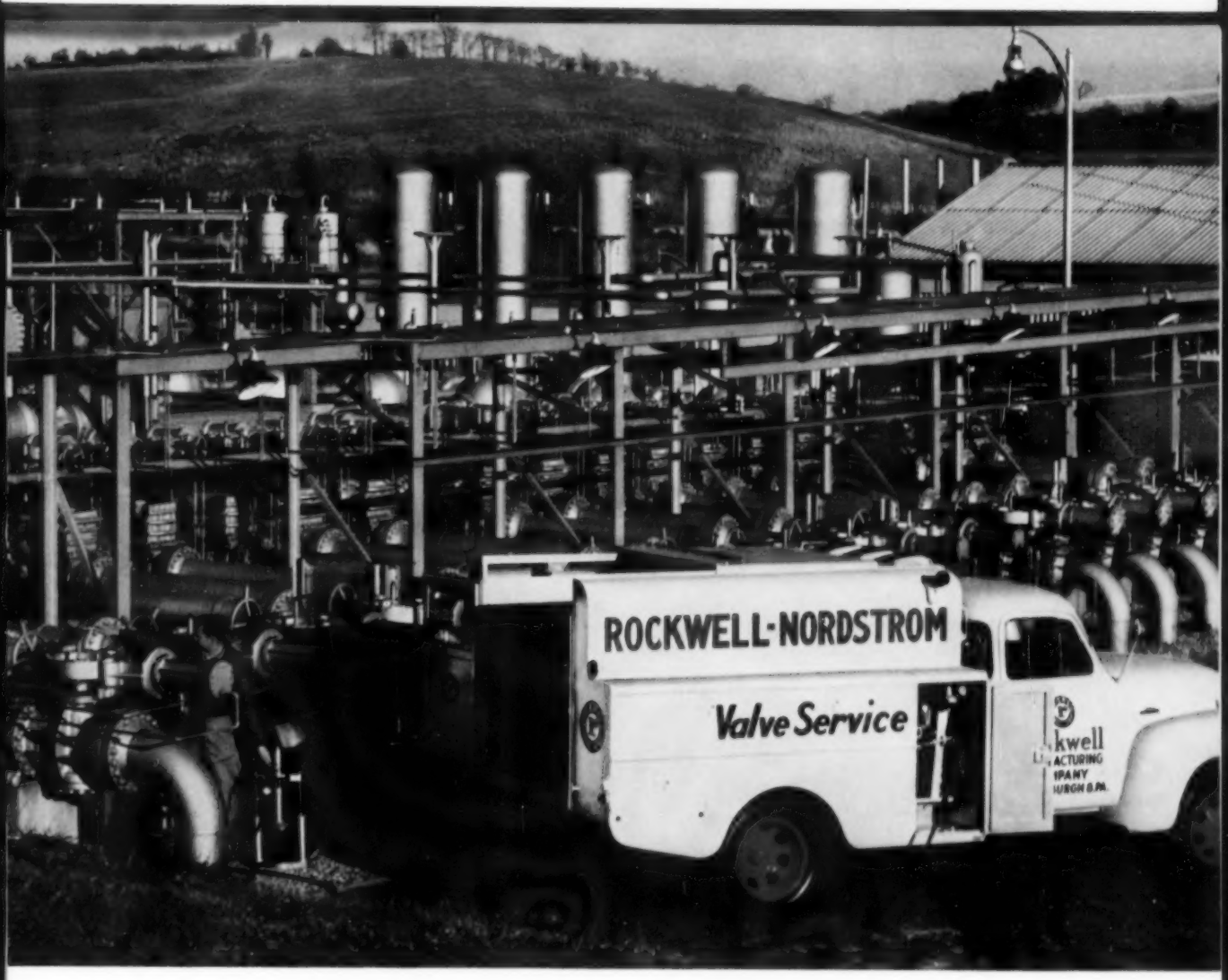


(Available in 15, 20, 30, 55 and 110 gal. sizes.)

The International Nickel Company, Inc.
67 Wall Street New York 5, N. Y.

INCO NICKEL ALLOYS

Monel . . . *for minimum maintenance*



Investment in Economy

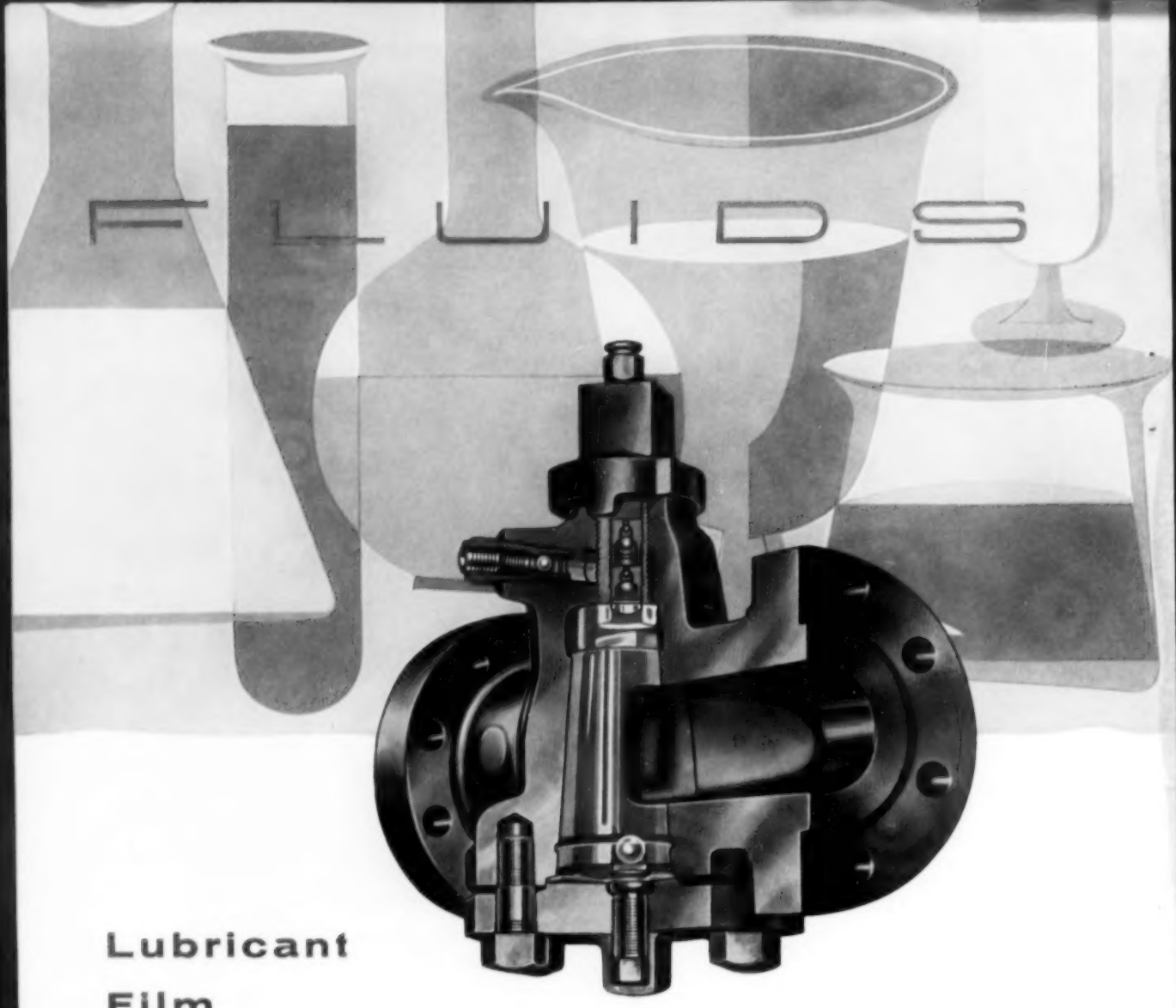
For forty years Rockwell-Nordstrom, the *original* lubricated plug valve, has built a reputation for valve economy. This year, Rockwell-Nordstrom users have even greater opportunities for valve economies through Rockwell's new mobile maintenance service, which is being made available on a contract basis.

Using the most up-to-date lubrication equipment on special Valve Lubrication Trucks, trained personnel will service all your Rockwell-Nordstrom valves on a schedule adapted to your individual requirements. These specialists will advise you on the correct Rockwell-Nordstrom lubricant for each of your services, and instruct your men on proper valve care that will allow further savings through greater efficiency and longer life.

Like Rockwell-Nordstrom valves themselves, this new Rockwell Contracted Maintenance Program has a single purpose: to give you the best valve service you've ever had, at the lowest cost per year. For complete information, write: Rockwell Manufacturing Company, Pittsburgh 8, Pa.

ROCKWELL-Nordstrom VALVES

LUBRICANT SEALED FOR POSITIVE SHUT-OFF



Lubricant Film Stops Metal-Hungry Fluids

Corrosive and erosive liquids are the nemesis of ordinary valves. But the thin, tough film of pressurized lubricant in Rockwell-Nordstrom valves forms an impregnable armor plating against them. And lubricant in the Sealdport* grooving provides a pressure seal that is dependably leak proof.

On liquid lines—or on any service—Rockwell-Nordstrom valves and lubricants will do a better job, longer, for less money. For complete information related to your valve problems, write: Rockwell Manufacturing Company, Pittsburgh 8, Pa.

*a registered trademark of Rockwell Manufacturing Company

ROCKWELL-Nordstrom VALVES

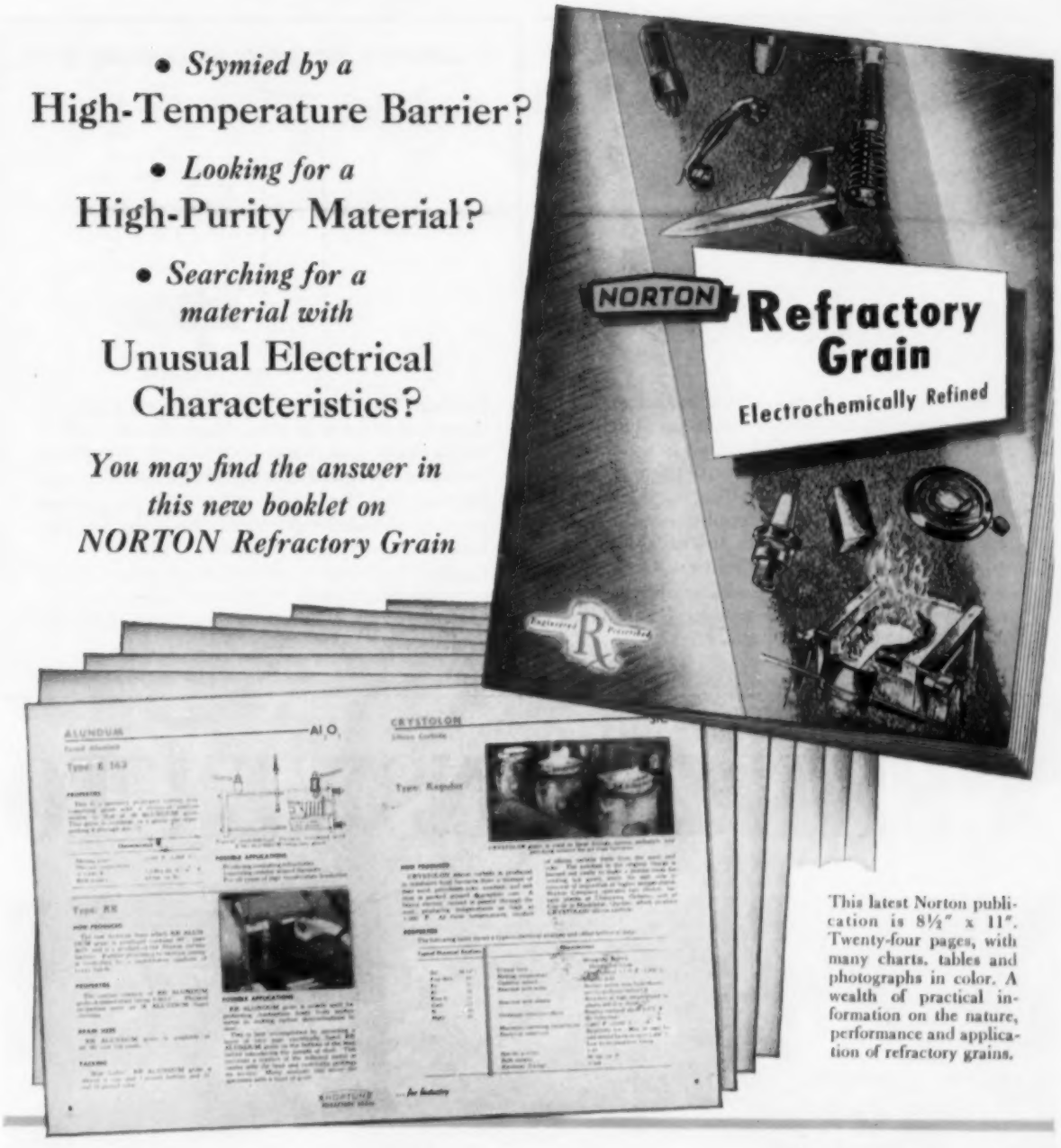
LUBRICANT SEALED FOR POSITIVE SHUT-OFF

• *Stymied by a*
High-Temperature Barrier?

• *Looking for a*
High-Purity Material?

• *Searching for a material with*
Unusual Electrical Characteristics?

You may find the answer in this new booklet on NORTON Refractory Grain



This latest Norton publication is 8½" x 11". Twenty-four pages, with many charts, tables and photographs in color. A wealth of practical information on the nature, performance and application of refractory grains.

IF you're concerned with industrial processing involving temperatures ranging upwards to 4000°C and materials to contain your inferno — if you're looking for a high-purity material such as high-purity fused alumina for coating electronic heater filaments — if you're searching for a material with unusual electrical characteristics such as E 179 CRYSTOLON* Silicon Carbide for lightning arrestors — one of the many types of Norton Refractory Grain available may solve your problem.

This new booklet describes in detail Norton Refractory Grain — produced and purified in electric arc and high temperature resistance furnaces — which is helping industry to improve existing products and processes and to create new ones.

It's a valuable reference book with up-to-the-minute information on the chemical and physical characteristics of such materials as CRYSTOLON* Silicon Carbide, ALUNDUM* Aluminum Oxide, MAGNORITE* Magnesium Oxide, Fused Zirconia and Boron Carbide. In it you'll find data on how these materials are produced; their behavior under varying conditions; available grain size and applications.

These electrochemically refined materials may be just what you've been looking for to solve your problem. Write today for your free copy of "Norton Refractory Grain." NORTON COMPANY, Refractories Division, 266 New Bond Street, Worcester 6, Mass.

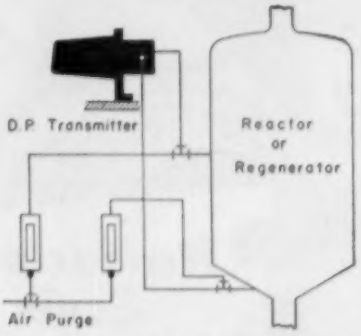
NORTON
REFRACTORIES
Engineered... Rx... Prescribed

Making better products... to make your products better

*Trade-Marks Reg. U. S. Pat. Off. and Foreign Countries

(To obtain more data on advertised products see page 1056)

CATALYST LEVEL

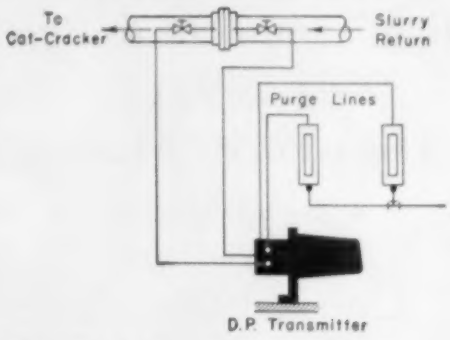


Problem: Sensitive Level Measurement of fluid catalyst in Reactor or Regenerator requiring a range of approximately 600 inches of water, and with a unit having parts common to other process measuring elements.

Solution: Use of a 333RD force-balance differential pressure transmitter with an available range adjustment of 80 to 800 inches of water.

Result: Accurate, Sensitive and Dependable level measurement with complete interchangeability of pneumatic transmitter parts.

AUTOMATIC PURGING OF SUSPENDED SOLIDS

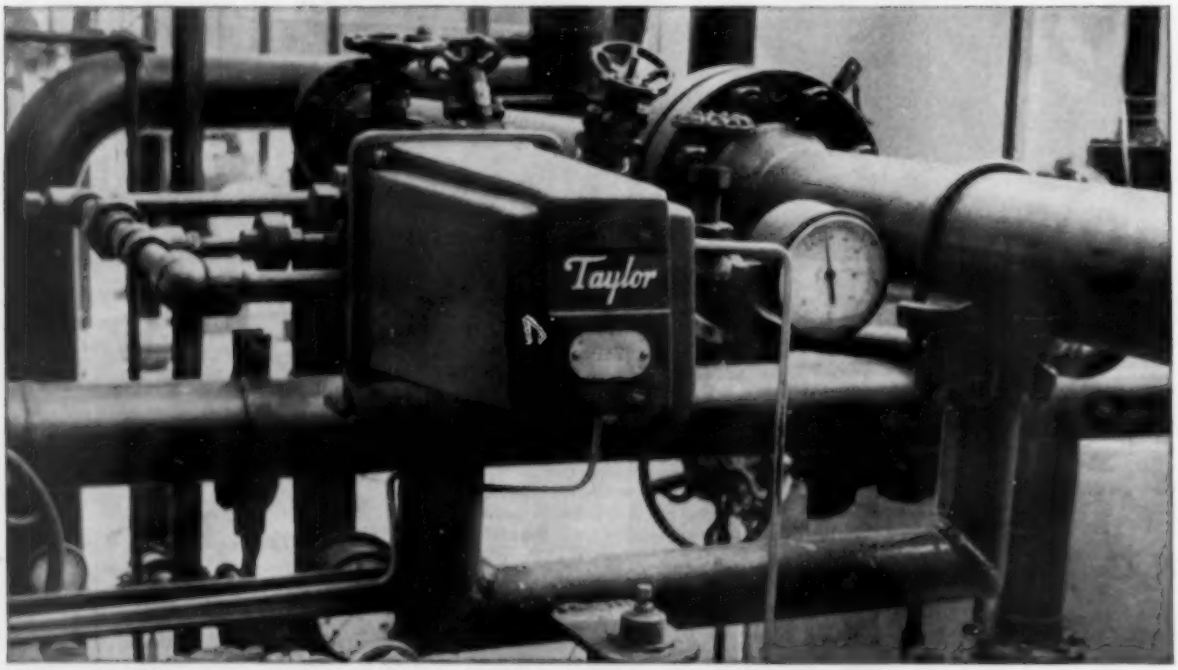


Problem: To obtain uninterrupted flow measurement and control in slurry lines where catalyst solids in suspension can settle out, plugging lead lines and meter, and causing measurement errors.

Solution: Dual body taps provide for purge connections which keep 333RD body, as well as lead lines, completely flushed.

Result: Consistent, dependable high measurement accuracy. Flushing of transmitter body as well as lead lines cuts maintenance to a minimum, especially after shutdown.

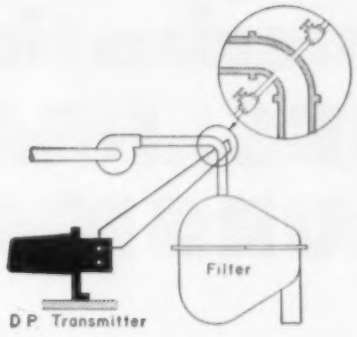
A SIMPLE ANSWER TO



One of the TRANSAIRE *Flow Transmitters on a reforming unit at Shell Oil Company's Wood River, Illinois, refinery.*

(To obtain more data on advertised products see page 1056)

SHORT RUNS—REVERSE FLOW—VARYING VISCOSITY

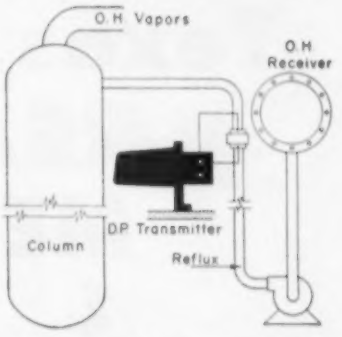


Problem: Dependable flow measurement installation where piping runs are too short for accurate orifice plate installation, the flow is reversed and/or flowing liquid has a varying viscosity.

Solution: The use of the 333RD Transmitter with Elbow Taps as primary elements. Since there is a tendency toward cavitation at the inside tap, the low volumetric displacement of the 333RD makes this type of installation practical.

Result: Accurate measurement and control under any one or more of these three difficult conditions.

WHEREVER A GOOD "WORK HORSE" IS REQUIRED



Problem: To improve flexibility, as well as reduce installation and maintenance costs of conventional flow instruments.

Solution: Standardizing on the 333RD Transmitter. 10-to-1 quick and easy range change; minimum volumetric displacement; may be installed for continuous draining and venting; light weight.

Result: Reduced maintenance cost due to time saved installing, changing of range, and eliminating periodic draining or venting.

DIFFICULT PROBLEMS!

The Taylor TRANSAIRE® Differential Pressure Transmitter (333RD) combines rugged simplicity with remarkable adaptability!

THREE of the applications illustrated above present difficult flow and level measurement problems: the fourth is an every-day installation. In each case the 333RD Transmitter handles the job accurately, dependably and economically.

This very versatile instrument is inexpensive and easy to install, and to maintain; changes in product or seasonal demand cause no problems, due to quick, simple range-change features; it follows flow changes quickly because of low volumetric displacement—has no seal pots.

Some of the features that make it so popular for refinery applications, are:

1. Good overrange protection, due to precisely designed and manufactured back-up plates and use of strong, flexible Teflon-coated glass fabric diaphragm.

2. Negligible temperature effect resulting from proven design principles and use of low-spring-rate materials.

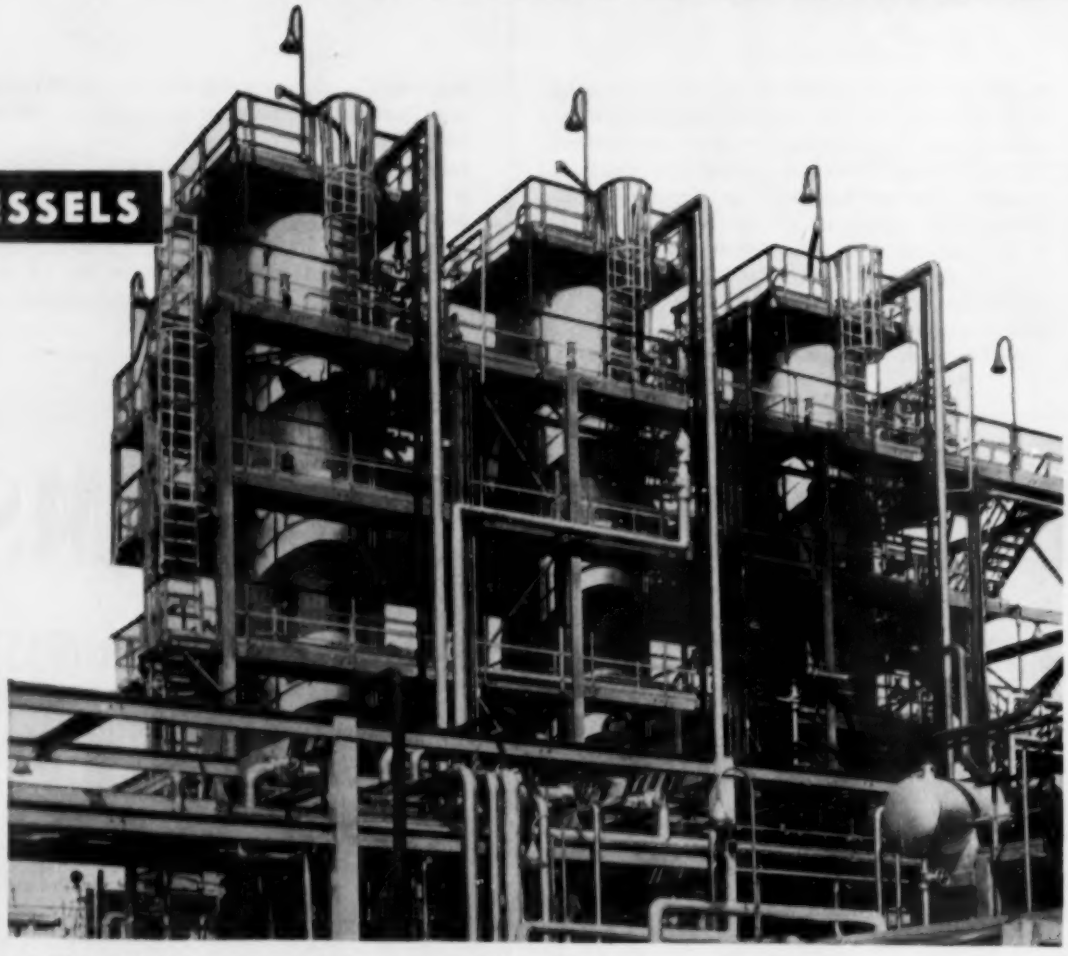
3. Ease of range suppression by means of an easily accessible, easily adjustable spring.

If you need dependably accurate measurement of flow, liquid level or specific gravity, it will pay you to look into the 333RD. Call your Taylor Field Engineer, or write for **Bulletin 98097.** Taylor Instrument Companies, Rochester, N.Y., or Toronto, Canada.

Taylor Instruments
MEAN
ACCURACY FIRST
IN HOME AND INDUSTRY

 (To obtain more data on advertised products see page 1056)

How A. O. Smith
Texas polymerization REACTORS, HEAT METALLURGICAL VESSELS



THIS installation shows that A. O. Smith service extends far beyond the usual supplying of vessels and exchangers to order. Here, our metallurgical research served to prescribe the chemical specifications used by the customer to improve the corrosion-resistance of specific reactor linings.

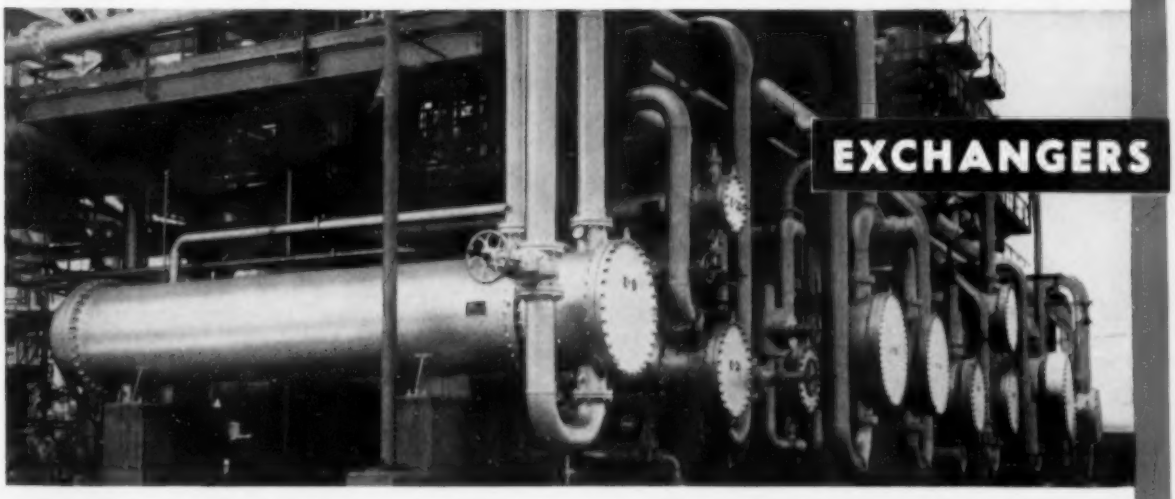
A. O. Smith supplied special pressure vessels, as well as five different kinds of heat exchangers for the phosphoric acid polymerization unit.

This typical example shows why the petroleum, petro-chemical and chemical industries bring their pressure vessel and heat exchanger problems to A. O. Smith.

Investigate A. O. Smith's performance in terms of your own processing needs. Write our nearest office. We'll be glad to give you detailed information about A. O. Smith pressure vessels and heat exchangers, engineering and research.

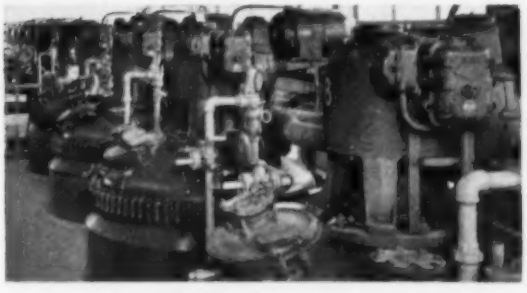
serves refineries

unit uses EXCHANGERS AND RESEARCH



Three A. O. Smith reactors with type 316 ELC lining are the heart of the unit. Designed for operating pressures of 640 psi, the vessels have 102-in. ID . . . are 58 ft. long with 2⅜ in. wall thickness.

The unit has 21 A. O. Smith heat exchangers. These include reboilers, condensers, coolers, heaters and exchangers, ranging in diameter from 15 to 51 in. We make all types of heat exchangers required by a petroleum refinery.



Broader service through Glascote — For more than 20 years, our subsidiary, Glascote Products, Inc., Cleveland, has been serving the process industries. Glascote can supply you with corrosion-resistant laboratory and pilot plant reactors . . . single-shell or jacketed storage tanks . . . double-jacketed condensers . . . columns.

Through research . . . a better way

A.O.Smith

CORPORATION

MILWAUKEE • HOUSTON • LOS ANGELES

Glascote Products, Inc., Cleveland, Ohio

International Division: Milwaukee 1

New Houdresid Process Completely Cracks the Bottom of the Petroleum Barrel, Increases Gasoline Yields.

The Houdry Process Corporation has announced an economically feasible process for catalytically cracking the bottom of the petroleum barrel. The new process, named *Houdresid*, converts reduced crudes into the most desirable refinery products.

Houdresid eliminates the need for expensive feed preparation processes. It also accomplishes a marked increase in gasoline yield; approximately 64 per cent gasoline is produced from the residuum as compared with 52.5 per cent gasoline yield from vacuum distillation plus catalytic cracking.

The Houdresid Process has been on stream for more than a year at the Sun Oil Refinery at Sarnia, Ontario.

For further information write to: Houdry Process Corporation, 1528 Walnut Street, Philadelphia 2, Pennsylvania.

HOUDRY PROCESS CORPORATION

PIONEER IN CATALYTIC PROCESSES

ALCOA ALUMINUM

Heat Exchanger Tubes are used by The Pure Oil Company at the Van, Texas, Gasoline Plant in

De-ethanizer Condenser
handling methane, trace propane, ethane

Rich Oil-Lean Oil Exchangers
handling rich oil with propane, butane, isobutane, gasoline

First Stage Compressor Aftercoolers
handling intake natural gas

Second Stage Compressor Aftercoolers
handling intake natural gas

Depropanizer Preheater
handling iso and normal butane, propane, gasoline

Absorber Intercooler
handling rich oil

Recompressor Aftercoolers
handling natural gas that is rich in propane, butane, gasoline

Residue Gas Coolers
handling cooling water

ALCOA Aluminum Heat Exchanger Tubes in the common sizes cost less than seamless tubes of other common materials. For example, seamless ALCOA Aluminum tubes cost two-thirds as much as seamless mild steel—one-half as much as Admiralty brass—one-third to one-fifth as much as cupronickel or stainless steel.

ALCOA Aluminum's natural resistance to attack by many corrosive materials results in longer life and lower maintenance costs. It prevents discoloration and contamination of products that require water whiteness. Tubes with alclad coatings offer even greater protection against perforation from pitting or localized corrosion.

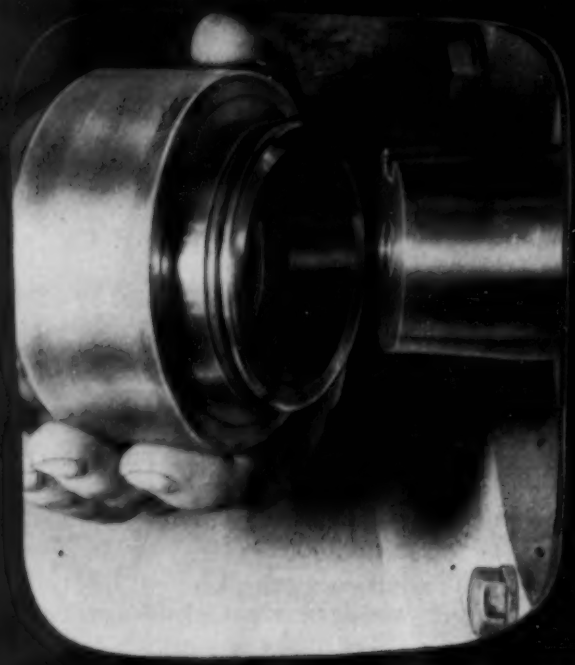
ALCOA ALUMINUM
ALUMINUM COMPANY OF AMERICA

Send for this new, FREE booklet.

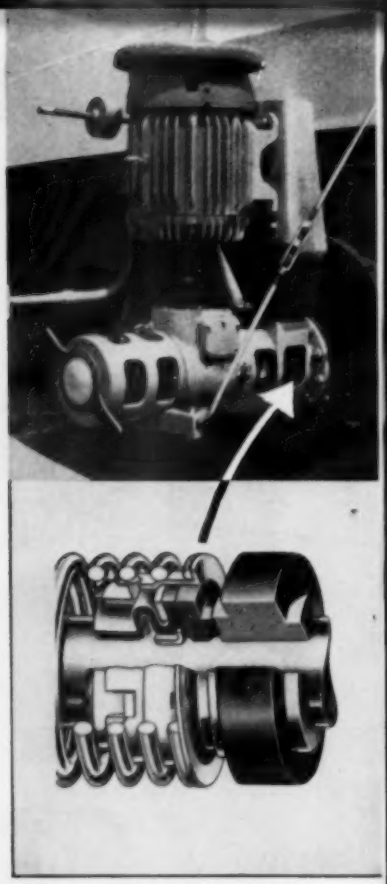
Aluminum Company of America
1000-G Alcoa Building, Mellon Square
Pittsburgh 19, Pennsylvania

Please send me a copy of your free, 24-page booklet, *Alcoa Aluminum Heat Exchanger Tubes.*

Name _____
Company _____
Address _____
City _____ Zone _____ State _____



REMOVABLE SEAL CARTRIDGE is a complete unit assembly, easy to stock as a replacement, or quickly obtainable in all sizes and materials, for the simplest or most difficult operating conditions.



YOU CAN REPLACE A LIGHTNIN rotary seal in a few minutes—without special skill, without draining the tank or dismantling the mixer, without losing a pint of product. Seal is shown here without housing, to illustrate components.

Newest cost-saver in side entering mixers:

End stuffing box repacking . . . forever

with a rotary seal that's easy to replace

Now you can enjoy the solid maintenance savings of leakproof rotary sealing in a side entering mixer—without the headaches seal replacement *used* to cause.

For here, at last, is a rotary seal that runs *years* without adjustment—yet can be replaced *in a few minutes* when necessary, without draining the tank or dismantling the mixer, and *without need for special skills.*

Here's what you gain when you specify LIGHTNIN Mixers with new LIGHTNIN Seals:

1. You end leakage—for good. The seal positively will not leak during its operating life.
2. You *eliminate* the cost of repacking stuffing boxes. The LIGHTNIN Seal takes the place of a stuffing box. Under most conditions, it runs smoothly for *years* without changing.
3. You stop costly "nursing" of stuffing boxes. The seal *never* needs adjustment.
4. And most important (because it's never been possible before)—you can replace a LIGHTNIN Seal *in a few minutes,* should it ever become necessary. Only one simple *cartridge* component to remove and replace—and you're back in operation. So simple, anyone who can handle a wrench can do the replacement job *in minutes.*

Already, many oil companies are using LIGHTNIN Seals. Users report savings running into many thousands of dollars per year. Your LIGHTNIN Mixer representative can give you the full story—show you how much *you* can save. Call him today. Or get the facts by mail: Send the coupon for 8-page, fully illustrated bulletin.

Get the cost-cutting facts NOW... New 8-page Bulletin B-111 shows how you get maintenance-free sealing that really slashes fluid mixing cost to a new low. Send also for LIGHTNIN Mixer catalogs listed here. Free—no obligation. Just check data you want, tear out and mail to us today with your name and company address.

- ☐ B-111 LIGHTNIN Rotary Mechanical Seals
- ☐ DH-50 and DH-51 Laboratory Mixers
- ☐ B-102 Top Entering Mixers (turbine and paddle types)
- ☐ B-103 Top Entering Mixers (propeller types)
- ☐ B-104 Side Entering Mixers
- ☐ B-107 Mixing Data Sheet
- ☐ B-108 Portable Mixers (electric and air-driven)
- ☐ B-110 Condensed Catalog (complete line)

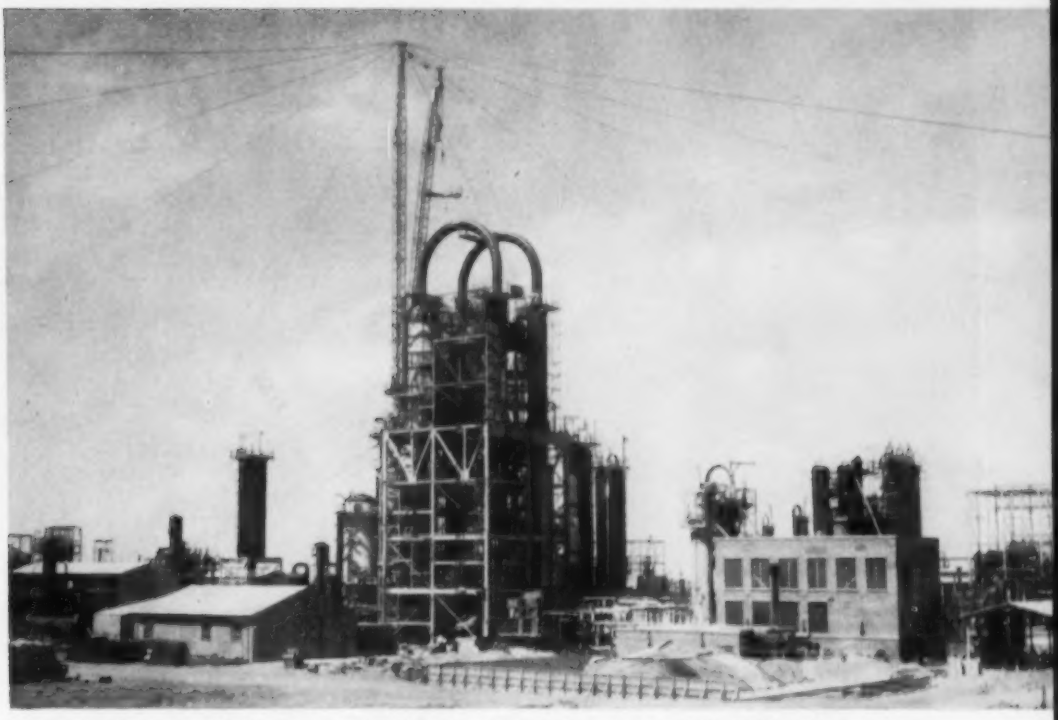
MIXING EQUIPMENT Co., Inc., 131-g Mt. Read Blvd., Rochester 11, N. Y.

In Canada: Greey Mixing Equipment, Ltd., 100 Miranda Ave., Toronto 10, Ont.

"Lightnin® Mixers"

MIXCO fluid mixing specialists

Petroleum Processing
JULY 1955



HEART OF SASOL plant is this gas synthesis unit, using an American version of the Fischer-Tropsch process

Oil From Coal—Full Scale

South Africa's Sasol plant is on stream—what is it like and why was it built?

By V. S. SWAMINATHAN
London, England

ON the broad, flat veld of the Union of South Africa, north of the lofty coastal mountains, and some 50 miles south of Johannesburg, the world's first large-scale, synthetic oil-from-coal plant has risen and gone into operation.

It is the new $84,000,000 "Sasol" plant, located on a 5000-acre site near Coalbrook, atop a vast supply of its raw material—coal. The plant lies on the Vaal River—the Union's major source of water—and within easy distance of its markets.

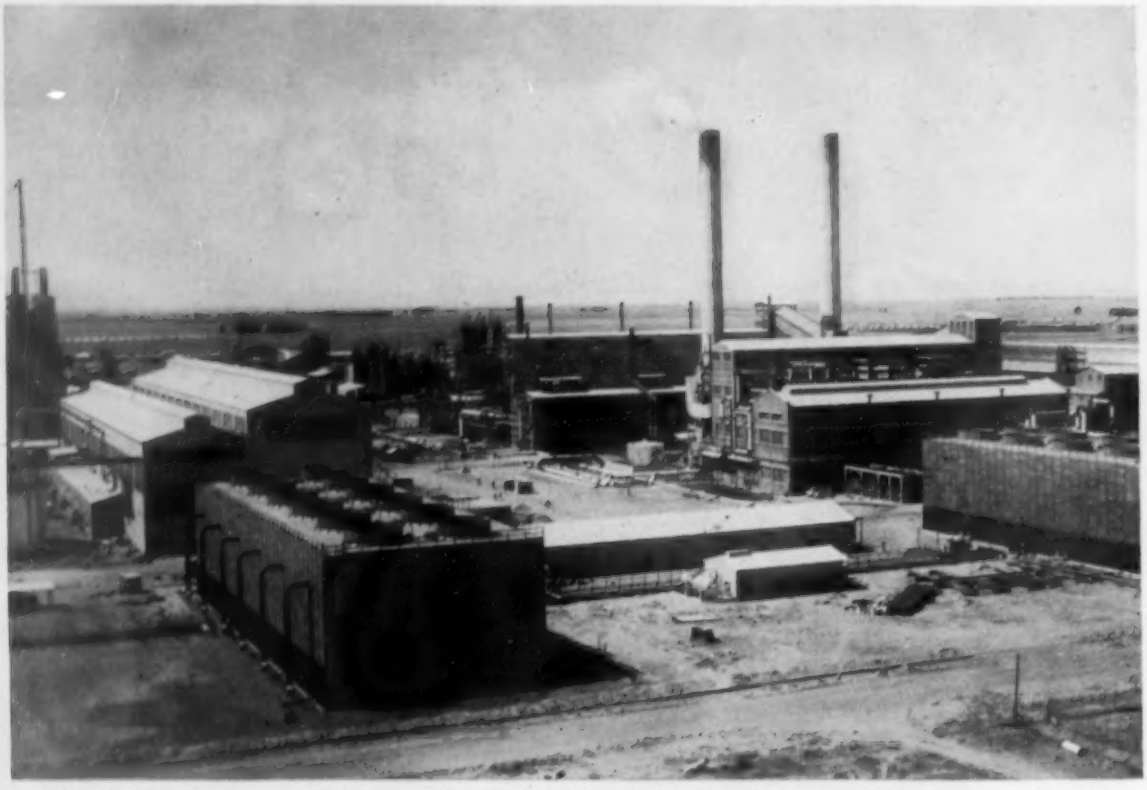
The word "Sasol" is derived from the firm's Afrikaans name—Suid-Afrikaanse Steenkool-Oile-en Gaskorporaisie Beperk. The English name is South African Coal, Oil, and Gas Corp.

The process employed at Coalbrook consists of: gasification of the coal, and then conversion of the gas into conventional petroleum products and chemicals using both American and German versions of the Fischer-Tropsch reaction technique.

A dozen main sections make up the complete Sasol plant:

1—Steam and power generation.
2—Tonnage oxygen production.
3—Gas producing and purification.
4—Catalyst preparation.
5—American type synthesis plant with refining and preparation units (Kellogg).
6—German type synthesis plant with refining and preparation units (Arge).
7—Methane gas reforming unit.
8—By-products plant.
9—Control house.
10—Tank farm and shipping facilities.
11—Cooling water plant.
12—Other auxiliary facilities.

In addition to the processing plant itself, the Coalbrook operation includes mechanized mining of the adjacent deposits to provide 7500 ton/day of coal, and establishment of a company town,



GENERAL VIEW: l. to r., gas synthesis unit (background), oxygen plant, cooling towers, gasification plant, and power plant

Sasolburg, for housing the employes and their families.

The three major raw materials for the plant are coal, steam, and oxygen. The total production of the synthesis gas—about 4,250,000 cu. ft./hr.—calls for 3200 ton/day of coal, 440,000 lbs/hr. of steam, and about 1,000,000 cu. ft./hr. of oxygen.

The coal used by Sasol is screened into three sizes. The two largest—1½ x ⅞ in., and ⅞ x ⅜ in.—are fed to the gasification plant, and the third size—about ⅜ x ⅛ in.—is fed to pulverizers which reduce it to powder for use in the steam generation plant.

The power plant consists of four 360,000-lb/hr. boilers generating the steam required for the synthesis gas and other units, and three 13,500 kw turbo-generators capable of meeting all electrical power needs for the plant, the mine, etc.

The boilers operate at a pressure of 575 psi. with an outlet steam temperature of 820°F. This high-pressure steam feeds to the coal gasification units, the turbo-generators, and to several plant sections where it serves as process steam and driving power for compressors, pumps, and the like.

The oxygen plant consists of six identical Linde type units, processing 9000 ton/day of air and producing 1800 ton/day of oxygen. The six turbine driven centrifugal air compressors deliver close to 1,500,000 cu. ft./hr. of air at 75 psi. to the Linde units. Three oxygen compressors deliver O_2 to the gasification unit at 426 psi.

Coal is gasified in nine Lurgi gas generators, under a pressure of 350 psi. by passing the oxygen and steam over it. This German "Rectisol" low-temperature extraction process (-40 to -60°C.) achieves in one step what formerly required five stages: dry oil scrubbing, pressure absorption of CO_2, removal of H_2S, activated carbon scrubbing, and final hot purification over alkaline iron oxide to remove organic sulfur.

Ash removed from the coal by water sluicing is pumped to an ash dump. By-products of the gasification process are taken to the appropriate units for recovery of ammonia, phenols, tar, etc.

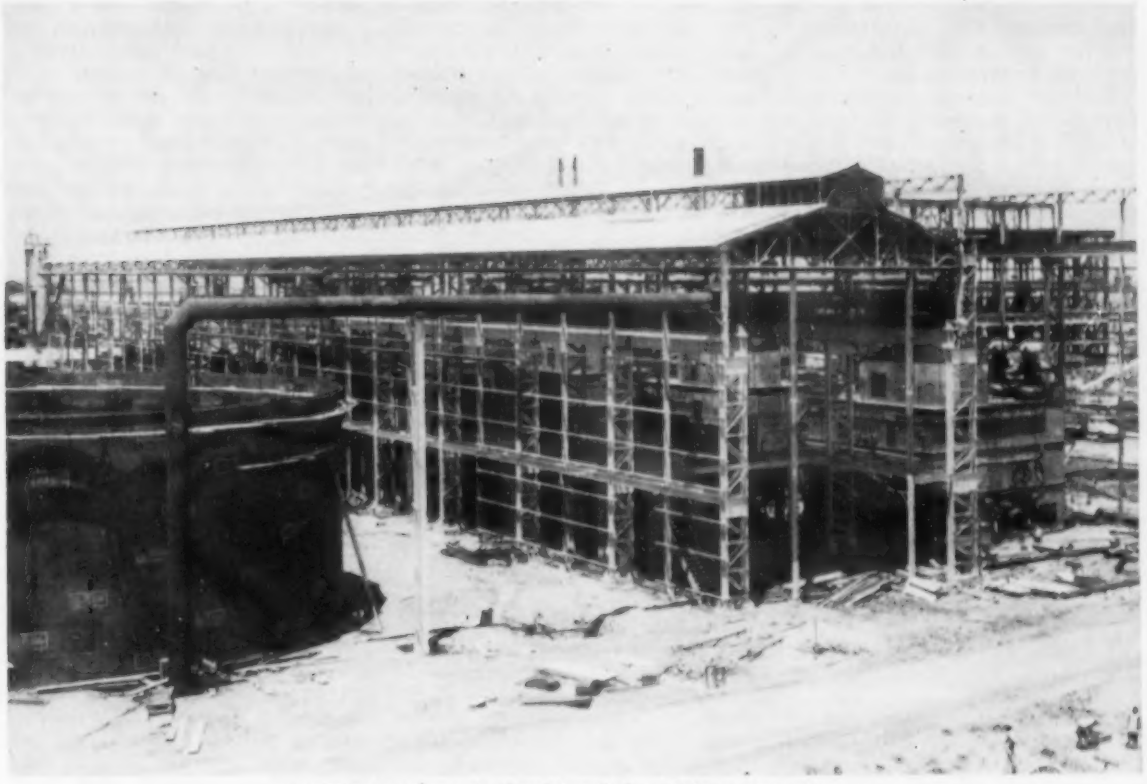
Purified synthesis gas—mainly CO and H—is of a composition suitable for the subsequent catalytic reactions. Two streams emerge from the gasification unit. One is fed to the Kellogg (American) synthesis plant, which is the larger of the two: the other to the Arge (German) synthesis plant.

Catalyst for the Kellogg process is manufactured in the catalyst preparation section. Magnetic iron ore is fused and compounded with promoters, crushed to a fine powder, and reduced with hydrogen to yield the activated catalyst.

The Kellogg process converts the synthesis gas to hydrocarbons and oxygenated products by bringing the powdered catalyst into contact with the gas in two large reactors. The catalyst is then separated and the reaction products pass on to product recovery, where they are condensed and separated into the various products by relatively standard refining techniques.

German development of the Fischer-Tropsch process has deviated from American practice in that a fixed bed catalytic operation is preferred to the fluidized technique. However, iron has replaced the original cobalt catalyst used. In the Arge plant at Coalbrook, which is about a third the capacity of the Kellogg unit, catalyst is in the form of small pellets. Products are recovered in the same manner as those from the Kellogg unit.

Light hydrocarbons from the synthesis and recovery sections are re-



OXYGEN PLANT at the Sasol installation during construction

formed to synthesis gas and re-circulated in the methane reforming unit. This operation takes place in the presence of steam and oxygen over a nickel catalyst. In the by-products section, ammonia, phenols, and other materials are extracted from the effluent of the gas generating plant, and the final effluent liquids are treated so as to be suitable for waste disposal in a conventional sewage plant.

A list of the conventional refinery products as well as the chemical materials to be made by Sasol is shown in the accompanying table. Storage facilities provide a total tankage capacity of 248,000 bbls. of the various liquid products. Shipping facilities are available for loading rail and truck tankers, and for filling drums.

The cooling water system incorporates four batteries of induced-draft cooling towers, constructed of Canadian red cedar wood, above concrete basins. Each of the largest towers is equipped with twelve 14-ft. diameter fans. The cooling water pumping station consists of six turbine-driven pumps, circulating about 150,000 gpm. of water through 4-ft. underground piping to the various sections of the plant.

Other auxiliary units include a large, two-story laboratory building, main stores building, machine shops, garage, and electrical, carpenter, and instrument shops.

Modern instrumentation and control equipment has been used throughout the processing operations. Besides the usual conventional recorders and controllers for temperature, pressure, flow, level, and the like; Sasol has used gas analyzers for monitoring the composition of gas streams continuously.

M. W. Kellogg Corp. engineered and supervised construction of the Sasol plant. Work on the project began in mid-1952. The Sigma colliery, providing the basic raw material, was brought into production on schedule, as was also the power station, oxygen plant, and gasifiers. Final units were completed earlier this year, and gasoline production began about April.

For its construction, the Sasol plant called for 56,000 cu. yds. of concrete. Nearly 32,000 tons of equipment and machinery was imported—about 25,000 tons of it from the United States. An equivalent tonnage of

What SASOL Will Make and How Much

Refinery Products

Materials	Planned Production
Gasoline, b/d	4,300
Diesel oil, b/d	335
Fuel oil, b/d	180
Paraffin waxes, 105 to 240° F. melt. pt., ton/yr.	18,000
Liquefied petroleum gas, imp.gal./day	720
Pitch & tar road primers, imp.gal./day	2,685

Chemical Products

Materials	Planned Production
Ethanol, imp.gal./yr.	4,000,000
Propanel, imp.gal./yr.	2,000,000
Butanol, imp.gal./yr.	525,000
Acetone, imp.gal./yr.	210,000
Methyl-ethyl-ketone, imp.gal./yr.	260,000
Mixed solvents, imp.gal./yr.	60,000
Benzene, imp.gal./yr.	500,000
Toluene, imp.gal./yr.	280,000
Xylene & solvent naphtha, imp.gal./yr.	500,000
Creosote wood preservative, imp.gal./yr.	1,000,000
Crude phenols, ton/yr.	6,000
Ammonium sulfate, ton/yr.	35,000

structual and reinforcing steel, as well as other equipment, was provided by local industry. Most of the piping—prior to erection—was fabricated in two shops on the plant site.

Use was made of a 230-ft. high derrick, with a capactiy of 70 tons, to place in position some of the heavier process equipment. Six other cranes were also employed, with capacities ranging from 13 to 60 tons.

More than 1300 Europeans and about 2000 Africans were engaged on the construction job. Sasol's total labor complement, including men hired for the housing project and for the coal mine, was 2000 Europeans and 4000 Africans. Because of the local scarcity of skilled craftsmen in certain trades, the company recruited labor in Europe. Around 250 persons and their families were brought to South Africa. A small number of plant operators also were recruited from the western countries in South Africa.

The sewage from the plant, the colliery, and the employe towns—plus the waste from the process units—is handled in one large installation. This section includes primary sedimentation tanks, sludge digesters, biological filters, rapid gravity filters, sludge drying beds, and humus tanks.

A total of 1,500,000 gal. of industrial waste and 960,000 gal. of sewage is treated daily to insure that the resulting material is entirely harmless, and is usable for agricultural purposes. Treated effluent goes to large earth dam, from which it is pumped via a 24-inch pipeline to the Vaal River.

The Sasol plant is serviced by a railroad from the Coalbrook station about 2½ miles away, and a total of 6½ miles of track have been laid. The plant is also linked by a new road to the main Vereeninging-Heilbron highway, and with Vanderbijl Park. The 5½ miles of main streets in the township have been tarred, and 12 miles of side streets gravelled.

What Made Sasol Possible?

THE justification for building the Sasol coal-to-oil plant in the Union of South Africa near Johannesburg was two-fold—strategic and economic.

From the security angle, the installation is based on a native raw material. The economic justification rests mainly on two big factors: 1) availability of thick seams of cheap coal at a shallow depth, and 2) prevailing heavy freight charges for transporting refined petroleum products from coastal points to the Johannesburg area. Gasoline can be shipped from the Sasol plant to Johannesburg for less than 25% the cost of moving it in from the coast.

Total demand by the Union of South Africa for petroleum products for inland consumption in 1954 was in the order of 40,000 b/d. Because of the lack of indigenous oil production—plus unattractive prospects for finding any—the government has invested about $84,000,000 in the Sasol installation.

When it's in full operation, the Sasol plant is expected to effect a saving in foreign exchange of about $19,600,000. This is from an annual production of approximately 50,000,000 gals. of gasoline and 16,000,000 gals. of other products, at a yearly product value of $25,200,000.

Gasoline will be produced at a cost of around 16.3¢/gal. (equivalent to the landed cost of imported gasoline), while the refinery selling price of about 25¢/gal. would give Sasol a profit of 8.7¢/gal. No provision has been made in this calculation for profits on sales of by-products.

Sasol's competition would seem to be from two other operations in the general area. South African Torbanite & Refining Co. (Satmar) refines crude shale oil produced at Ermelo, 140 miles east of Johannesburg, producing about 300 b/d of gasoline. Secondly, the Stanvac plant at Durban, which went onstream in early 1954, has a daily throughput of 17,300 bbls. Stanvac obtains its crude from the Persian Gulf region.

Gasoline will not be sold only as a separate product, according to Sasol's plans. About two-thirds of the total will be marketed through existing channels under an agreement with the four oil importing companies—Atlantic (whose marketing facilities in the region were purchased in 1954 by British Petroleum Co.), Caltex, Shell, and Stanvac. The remaining third, along with Satmar's production, will be sold as a Sasol product.

As to the chemicals, the company's policy is not to extend the output beyond immediately salable products. It is hoping that private enterprise will undertake the establishment of an organic chemical industry in the Union of South Africa.

Low raw materials costs are another important factor in the economic justification for the Sasol installation. The plant site is on top of a huge coal field and along the banks of the Vaal River.

Sasol's mineral rights cover an area of some 13,650 acres, holding 665,000,000 tons of coal of which 300,000,000 tons are extractable. Mining at the rate of about 7500 ton/day, Sasol has almost 110 years' supply of extractable coal.

Local mining costs compare very favorably against others. It costs Sasol 70¢/ton to mine its coal. Costs in the United States range from $2.00 to $4.00/ton, and in Great Britain up to $8.82/ton. The average proximate analysis of this coal is:

Calorific value, Btu/lb. (gross)	8400
Ash content, %	27-30
Volatile matter, %	23
Fixed carbon, %	44
Moisture, %	6-8

Low labor cost is a key factor. The company's own mine—the Sigma colliery—extracts the 7500 ton/day used by the plant with the latest mechanized equipment, and a labor force of 350 surface and underground African workers and a total European staff of 40. This is less than one-sixth the number of Africans and less than one-third the number of Europeans usually employed in a conventional South African colliery.

Based on these figures, output per man per day comes to about 20 tons. This compares favorably with U. S. practice, although some of the more efficient American mines have reported production rates of as high as 40 ton/man/day.

Extensive use is made of all types of mechanical equipment: mobile power coal cutters, mechanical loaders, shuttle cars, belt feeders, and a conveyor belt system. The hydraulically operated coal cutters are fitted with 9-ft. cutter bars, each of which can cut a block of coal measuring 9x9x30 ft. in one operation.

Included in the conveyor system to carry the coal to the surface after preliminary underground crushing are two of the longest conveyors built in the Union of South Africa. Each one is three ft. wide x 3200 ft. long, and is designed to move coal at 400 tons/hr.

Sasol was financed through the Industrial Development Corp. to whom the Union of South Africa government advanced the necessary funds. As of June 30, 1954, the company's share capital was $70,000,000. Capital expenditures for the year ending that date were $75,000,000. The main element in this outlay had been some $33,600,000 in connection with the plant construction. Sasol, and Sasol Townships Ltd., will eventually spend $9,800,000 on township development and housing.

PART 4—Concluding the series on "KEEP THOSE PRESSURE VESSELS SAFE"

Safety Relief System Inspection

Factors to consider in checking valves and complete vapor relieving systems

By WALTER SAMANS
Consultant on Pressure Vessels

THERE are a number of factors which can interfere with the proper operation of safety valves of any type. The safety valve inspector should be familiar with these factors which include:

1—Damaged stem packing, usually indicated by leakage that cannot be stopped except by replacement of the packing.

2—Corroded parts, where the leakage of contents that are corrosive is not drained away, and the valve materials exposed to the corrosive material are not resistant.

3—Plugging of vent or drainage outlets by scale, dirt, residue from evaporated leakage, or any other solid or semi-solid matter.

4—Corroded or overheated valve springs resulting from the use of an unsuitable valve, or a valve with unsuitable materials of construction.

5—Mechanical wear, due to pounding (chattering) of the valve disc on the seat. Chattering is not usual in processing plants where the relief-type of safety valve is in general use.

Safety Valve Springs and Their Limitations

Various reasons — discussed below —make it impossible positively to retain safety valve set pressures within the small safety tolerances allowed by the pressure vessel codes. It is nevertheless necessary that the valve repair shop try to use sound judgment so that appreciable errors will not occur.

New valves and springs can meet the set pressure tolerance requirement —*Section VIII, ASME Code for Unfired Pressure Vessels, paragraph UG-133 (f)*—of not more than plus or minus 2 psi. for pressures up to and including 70 psi., and 3% for pressures above 70 psi.

It is after a spring has been in service for a time that its characteristics may have been affected by exposure to corrosive elements, with or without excessive temperatures.

The spring should be immediately discarded, or replaced as soon as possible, after signs of stress corrosion or incipient cracking are found. Replacement should be with a spring having the correct rating and material for the service.

When changing service conditions, or when a spring not exactly suitable has been installed temporarily, the setting should not be more than 10% under or over that for which the manufacturer has marked the spring for services up to service pressures of 250 psi.—above 250 psi. it is 5%.

Temporary use of springs marked for a lesser pressure than required for the specified setting is permissible when a test shows that at the pressure for maximum flow the lift shall not be restricted by the spring being too nearly closed.

Safety Precautions in Servicing Safety Valves

Safety masks, goggles, protective clothing, and suitable conveniently located emergency facilities for inspection personnel should be provided, particularly where corrosive, toxic, flammable, or hot fluids can escape in the places where the pressure-relief devices are to be removed or replaced.

Never should safety devices be serviced or removed from vessels under pressure—or even have packings or gaskets replaced—unless it can be assured that there will be no escape of the vessel's contents by the safety device orifice or outlet.

Should the safety device have to be removed from its mounting, any valves through which hazardous fluids could be admitted to the safety relief section of the system should be closed tightly and sealed.

Before dismantling safety-valve discharge piping with the connected shut-off (stop) valves, the pressure vessel or vessels involved should be drained and safe-blanked at connections to any active outside systems.

Safety Device Inspection Reports

Several types of report forms are suggested by the API Pressure Relieving Devices Code.[1]

It will be found advantageous to have sketches of the piping between the safety-valve and the vessel shown with approximate dimensions, whenever a fouling condition is noted. These sketches can then be studied by others who are jointly responsible for the operating facilities provided, who can decide if an undesirable condition may be ameliorated by some slight change in the hook-up.

Checking Safety Valve Inspection Tools

A complete inspection service will provide the necessary means of checking the accuracy of all tools used in valve inspection.

This checking may require the services of tool room personnel to make special mechanical gages or, where there is a regular testing department that keeps its own instruments in proper accurate working order, its personnel may handle the maintenance of all such inspection devices.

Otherwise, any devices found to be inoperable or inaccurate should be sent back to the manufacturer promptly for repairs per instructions normally sent with a device when new.

Plant adjustments are practical for the simpler deficiencies which may occur in the weight-operated testing equipment for checking springs, spring settings, so that the valve will open to the required lift—unless the manu-

facturer of the device insists in his guarantee that he should make all repairs.

Record of Inspection Tools

A complete record should be kept for all tools that are special for valve repairs. Tools needed are recommended or supplied by the safety and relief valve manufacturers for their respective products.

A serial number record will provide the accession dates, and card records are often best for a history of the changes and repairs.

Each plant should devise its own methods of keeping records, and see that they are properly kept.

Installation Rules To Be Checked by Inspection

The following rules for the safe installation of safety relief devices, and their purposes, should be fully understood by inspectors of these and similar devices.

Several pressure-relief valves may be placed on a single outlet where the relief outflow capacity required is too large to be practical for a single valve. Also heavy surges in the evaporation of contents relieving through a single valve may be reduced by using several smaller valves with springs set so that only one valve will open at a time. Rules for the variable setting of the valve opening pressure are given in the pressure vessel construction codes.

Other reasons for multiple safety valve installations have been discussed in Part 3 (PETROLEUM PROCESSING, pp. 849-853, June, 1955), and include preventing valve injury by "simmering" and the giving of an overpressure warning as soon as the first valve pops —thus allowing corrective action before the entire vessel contents are lost.

Valve seat deposits may result from the simmering condition of valves, usually in hot service where temperature strains may result in poor seating alignment. Likewise, priming of vessel contents through the valve may throw deposits into the discharge piping. These conditions need to be investigated from time to time, particularly on closed discharge systems.

Rapid deterioration of materials for the valve internal parts or trim means that the conformance of the valve to the specifications should be checked with the design engineers, or with whoever ordered the valve for this service, before ordering new materials.

One or more spare valves on the vessel outlet is required under the *API-ASME Code for Unfired Pressure Vessels*, or recommendations for vessel installation in plants maintained in a practically continuous processing operation. That is to say that if one of these valves is to be tested in place or out of service, or must be temporarily removed for repairs while operation is continued, the remaining valve or valves should have sufficient flow capacity to take care of the specified relieving capacity for the vessel or vessels served.

In such installations it is permissible to mount each safety or relief valve on the outlet side of a stop valve, provided this stop valve is tightly closed and sealed or locked shut while the spare valves are being tested or are removed.

Replacement of the removed valves should be prompt, and an authorized person should remain at the safety valve location during the entire procedure.

For small capacity units with a small required relieving capacity where continuous operation is essential, there may be only two relief valves—either of which will have the required relieving flow capacity—for the pressurized system.

The two valves will usually be mounted on a short twin-outlet nozzle (Y type) in which a three-way cock acts as the stop valve. The cock is always open to one or the other of the two safety valves, while the remaining valve is locked off to permit its removal (see paragraph *UG-134* and *Appendix M, Section VIII, ASME Code*. Similar rules are included in the *API-ASME Code*).

Pressure-Relieving Systems*

In modern pressurized chemical and petroleum processing, it soon developed that experience gained in steam power plants for discharging excess steam pressures could not contribute much for other than mono-molecular fluids.

Design experience for steam power plants with regard to strength and selection of proper materials, and allowance for pressure surges, did furnish a start for design in the chemical and petroleum industries, but failed to consider the many unknown elements introduced by fluids other than steam, and the possible incompatability of running the various intermediary product discharges into a common line.

Problems not common to steam power plants include the corrosiveness of the chemical fluids, the need for quench sprays to reduce temperatures in safety valve discharges, and the need for providing room for expansion of evaporated vapors from suddenly "released" superheated liquids.

The flammable nature of petroleum and chemical discharges was also a factor not considered in steam power plant pressure relief.

Valve Selection and Design for Pressure-Relieving Systems

The importance of getting the proper type of safety valve to fit all conditions imposed by a pressure-relieving system, as compared to plants handling mono-molecular fluids, involves the effect of back pressure in the relief discharge line—especially in closed discharge systems—on the set pressure of the relief valves in the system.

Safety "pop" and "relief" valves—long used in the simpler plants on single closely piped cluster or group installations with short discharge piping in one-at-a-time controlled opening for liquid or superheated liquid discharge operation—had no measurable loss in flow capacity because of the back pressure developed.

For complete systems laid out for any one or more of the above reasons, it was quickly realized that to discharge all of the plant's relief devices into a common header simultaneously would exceed the limits of permissible back pressure, and affect the flow capacity ratings of the conventional relief valves.

In actual design practice, the reasonable probability of a certain number of relief devices discharging simultaneously must be assumed by the design engineer.

The worst possible emergency discharge situations usually exist during failures in the cooling water systems, or accidental plant fires.

In isolated light product storage plants it is not always possible to predict the safety relief flow capacity needed for common headers.

Safeguards against fires are based on many years of experience, and usually assure quick drainage of spills away from the affected areas.

Dual discharge systems—with segre-

* The inclusion of this subject is limited in this section, due to the great amount of information already or soon to be available from other sources. The Division of Refining of the American Petroleum Institute is preparing a publication on "Recommended Practices for the Design and Construction of Pressure-Relieving Systems in Refineries" (Tentative) with issue anticipated in 1955. Also, inspection methods for pressure vessels and their safety devices will not be different in principle than for single plant units, but greater care is needed in safety precautions during inspection and in setting relieving pressures of safety valves. Additional information on this subject is available in reference (2).

gation of higher-pressure relief discharge streams from those of markedly lower discharge pressure—are becoming customary in large plants, even though there is little chance of very many safety relief valves blowing simultaneously.

The decision on the separation of the high and low pressure discharge streams is open to the judgment of the design engineers who may confer with safety and fire-prevention engineers.

Balanced type pressure-relief valves are coming into greater use in safety relief systems, due to the negligible effect of discharge header back pressure on the set pressure of the balanced valve (see Part 3, PETROLEUM PROCESSING, Fig. 2, p. 850, June, 1955).

Installation and maintenance of all types of pressure-relief valves in common discharge systems can be obtained from the several safety valve manufacturers for their particular types of valves.

Inspectors should familiarize themselves with such detailed instructive information as their work develops the need for its immediate use.

References

(1) American Petroleum Institute, 50 W. 50th St., New York 20, N.Y., "Recommended Practices for Refinery Inspections": Part I — Process Equipment, Division of Refining, 1948 (being revised); Part II — Pressure Relieving Devices, Division of Refining, 1949.

(2) George Armistead, Jr., "Safety in Petroleum Refining and Related Industries", compiled for John G. Simmonds & Co., Inc., 1950. (For copies, address Security Publ. Cor., 1200 Eighteenth St., N.W., Washington 6, D.C.)

(3) API-ASME Code for Unfired Pressure Vessels for Petroleum Liquids and Gases, (1951 Edition and Supplement in preparation), Publications Department, American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N.Y.

(4) ASME Code for Unfired Pressure Vessels, Section VIII of the Boiler and Pressure Vessel Code, 1952 ed. AEME (See Reference 3)

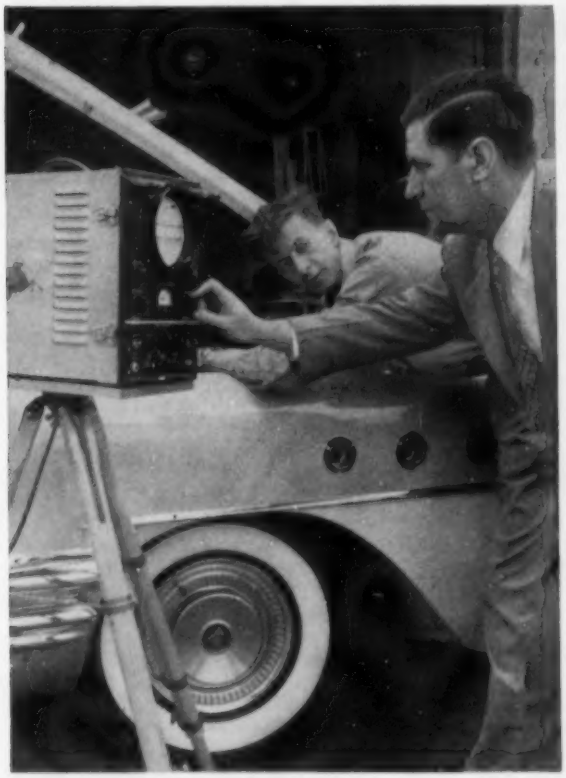
(5) Lloyd J. Oye, "Non-destructive Testing of Structures", *The Welding Journal*, pp 223-237, March 1954.

(6) Carr, E. W., *Valve World*, No. Four, 1953, The Crane Company, 836 S. Michigan Ave., Chicago 5, Ill.

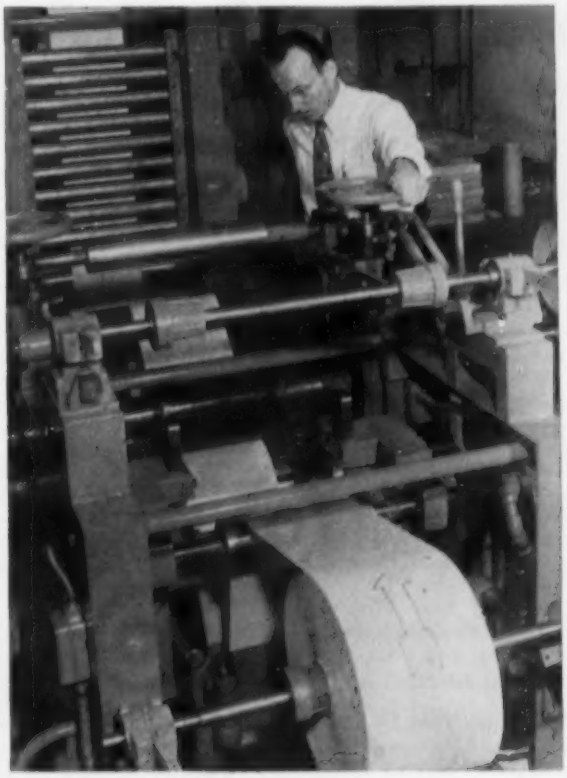
(7) Instructions for Installation and Maintenance of Consolidated Safety Relief Valves, Manning, Maxwell & Moore, Inc., Tulsa, Okla.

(8) Principles of Manifold Discharge Piping Application, Manual 51-B, Farris Engineering Corp., 400 Commercial Ave., Palisades Park, N.J.

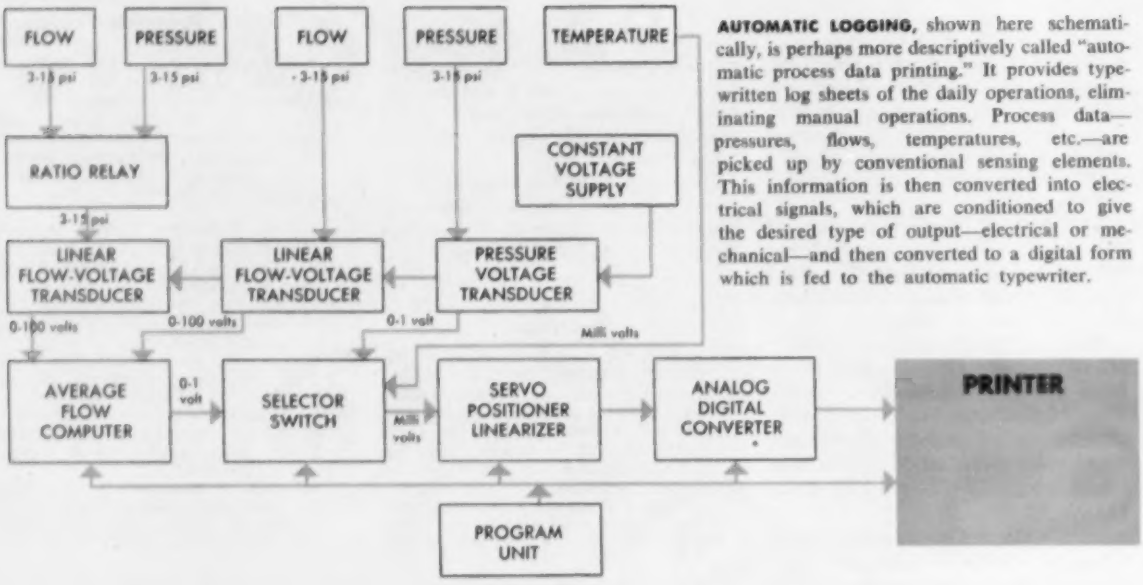
NEWS in VIEWS



AUTOMOBILE "DOCTOR" is this new electronic analyzer for testing engines, developed by the research laboratories of Socony Mobil Oil, Inc. It will be manufactured and sold by the Allen B. Du Mont Laboratories, Inc., under a licensing agreement. Shown operating the analyzer are (l. to r.) mechanic Harold Rickert and research associate J. Howell Goffe, who directed the development work. The analyzer itself was invented by A. E. Traver, electronics engineer at Socony's Brooklyn laboratories.



OUT OF PLACE IN THE OIL INDUSTRY? Not at the Esso Research Center in Linden, N. J. This is a coating machine which researchers use to prepare waxed papers for testing, and is a small version of equipment used by paper manufacturers. Although only about 0.5% of all crude oil is refined into wax products, this relatively small volume represented about a $110,000,000 business in 1954. It is one of the more unique petroleum products in that it is readily visible to the general public.



AUTOMATIC LOGGING, shown here schematically, is perhaps more descriptively called "automatic process data printing." It provides typewritten log sheets of the daily operations, eliminating manual operations. Process data—pressures, flows, temperatures, etc.—are picked up by conventional sensing elements. This information is then converted into electrical signals, which are conditioned to give the desired type of output—electrical or mechanical—and then converted to a digital form which is fed to the automatic typewriter.

Do You Need Automatic Logging?

THAT push-button plant there has been so much talk about may seem a long time away to most processors today.

But there is one new control tool which has been gaining in interest quite fast these days, and that's automatic logging, or—if you prefer—"automatic process data printing." In addition to a fairly hefty list of advantages claimed for it, its proponents quickly point out it is also a step in the right direction toward the so-called push-button plant.

These advantages include such tangible items as: less operating manpower, increased operating efficiency, and accuracy. If you're looking into this field, what questions should you ask yourself? What kinds of answers would automatic logging give to these questions?

Can you use the savings of one man per shift in operating a process unit?

An automatic logger can save you that much—by handling the routine clerical job at least one of the operators has to do normally.

For example: an accurate appraisal of the manpower requirements on a given process unit might be determined as 4½ men per shift. This process unit will require the manual tabulation of many process variables on the log sheet at regular hourly intervals. If the number of variables is great enough, this tabulation may require as much as a half a man per shift. It's quite obvious that a half man is not available, but rather a whole man will have to be utilized. If this clerical function is supplied by the automatic logger, a savings of a man per shift can be realized. The elimination of marginal manpower is a definite increase in operating efficiency.

Do you want accurate, usable records during "upsets"?

During extreme conditions when the unit is upset, operating personnel frequently are busiest. Then the log sheet is forgotten. Yet, this is the time when the process data is most valuable. The engineering staff later may have to scan many conventional recording charts to ferret out information as to causes for the upset and actions required to return the process to normal conditions. Synchronization of these charts is inaccurate frequently, and a good process analysis is difficult.

The automatic logger gets around this problem. If desired, it can be set to speed up during upsets, printing out in a continuous manner instead of at hourly intervals. And, the time of recording the data can be determined accurately. Process analysis is simplified, because it requires only the observation of the log sheet tabulations rather than thumbing through countless conventional charts.

Is accuracy a must in your log sheets?

Automatic logging provides accuracy usually better than that obtainable with human data-taking. The routine "fatigue" usually experienced by data-taking personnel is by itself a large source of inaccuracy. It is also probable that some operators may skip reading certain data points when they are busy, since these change infrequently in magnitude. Operators may at times merely copy the previous hourly reading.

The accuracy of an automatic logger can be made ±½% on normal flows and pressures, and to the nearest °F. for three-digit temperatures. This accuracy, using flow for an example, would hold—and even include receiving—a 3 to 15 psig. air signal from a flow transmitter, transducing it to an electrical voltage, linearizing the square root signal, multiplying it by a flow constant, measuring and digitalizing, and finally typing it out on a printed log sheet.

Do you have a multiplicity of operating data to analyze?

The automatic logger permits presentation of much information in a systematic and easily analyzed form. This enables a process operator to observe and correct more process variables than can be done with conventional forms of recording instruments.

It can result in eliminating manpower, and can also make the retained manpower more effective.

Beyond this, it can make more feasible the use of centralized control houses for multiple plant operation. In multi-plant operation, frequently 200 data points are to be logged hourly. This would probably be a full time job for one man. It can be accomplished in minutes with automatic logging, rather than over the hour-long period. Also, the data is more meaningful since it is taken over a much shorter interval of time.

Would you like continuous scanning?

An automatic logger can be used for this purpose, with high and low limits built-in to sound the necessary alarms when process variables are off specifications. This can eliminate the use of conventional panel-type alarms and result in a saving in equipment. A print-out in red can be provided when one or more variables are off specifications.

By utilizing a system such as this, the more critical process variables can be quickly determined. The system lends itself more readily to some form of statistical analysis. With this information, the process operator can quickly determine which are the most critical variables for a given situation, and can devote his attention to them for effective process control.

Do you want to eliminate a few recorders for the non-critical variables?

By careful planning, this may be possible. Automatic, or manual, selection can be provided for monitoring these variables on multi-point strip chart recorders. The automatic selection can be provided through the alarm system of the logger, or selection can be made manually when the variables become of interest.

What other improvements are you seeking for your control room operation?

Automatic logging offers a number of further possibilities. Among them are:

1—By including simple and reliable information storage devices, it is possible to type out the integrated flows, or any other information, at the end of a day's operation.

2—It is possible to compensate continuously for the fluid pressure when measuring a gas flow. The flow of a gas is proportional to the square root of its absolute operating pressure.

Union Oil Will Use Logger on New Coker

ONE of the first applications of an electric data reduction system on a large scale will be an automatic logger being installed at the new Santa Maria, Calif., refinery of Union Oil Co. of California.

The system will monitor two 10,000 b/d coking units, scanning and recording some 300 variables—temperatures, pressures, and flow. It can scan at intervals as close as one minute. It will print—via two IBM typewriters—the highs and lows at desired intervals from 5 min. to two hours. It will give a warning when any reading varies beyond preset limits.

The instrument will do no computing, nor will it control operations. It could be adapted for control, but Union has no plans at present for using it for that purpose. The system was designed by Union and Betchel Corp. engineers, and is being built by Panellit, Inc. The basic components are servomechanisms.

3—Manual planimetering of charts will be eliminated by having the material balance automatically printed out at the end of a day's production. Thus, a manpower saving can be realized in the process accounting department.

4—Material balances, or other data, can be telemetered to a remote location if desired, to be printed and observed, and placed on punched cards or tape for further uses.

5—The logger is not only suitable for large process units. It has a tremendous value in the research field, particularly in pilot plant studies. Large quantities of pertinent data must be taken and analyzed in a pilot plant operation. By automatic logging and the various tape and punch card techniques, the research man's job is made simpler, faster, less tedious, and more accurate and productive.

The automatic logger is the process industry's first form of contact with a reasonably large size computer in continuous operation. Much can be learned from it.

The next logical step would seem to be centralized computer control, which would result in the automatic plant. Probably the automatic logger would feed data from conventional and from analytical instruments into a computer which contains the parameters of the process. The computer in turn would reset the indexes of the single and multiple loop controllers to achieve automatic plant operation.

Acknowledgment

The preceding information is based on two talks given at a New York Section meeting of the Instrument Society of America by Esso Standard Oil Co. instrument engineers. Mr. Daniel J. Dinzik, with Esso since February, 1951, is a technical assistant to the instrument dept., and spoke on "The Value of Automatic Logging to Management." Mr. Howard S. Andrews, also a technical assistant to the instrument dept. at Bayway, has been with Esso since 1937. His topic was "Primary Sensing Elements and Signal Conditioning Devices," and the schematic diagram is from his paper.

Who Makes Automatic Logging Systems?

These are manufacturers known to be furnishing and installing automatic data reduction and presentation equipment, or who are experimenting in the field:

The Austin Co.
Beckman Instruments, Inc.
Benson-Lehner Co.
Berkeley Co.
Consolidated Engrg. Co.
Cook Electric Co.
Fischer & Porter Co.
International Business Machines
G. M. Giannini & Co.
Leeds & Northrup Co.
Librascope, Inc.
Metro-Type Corp.
Minneapolis-Honeywell Regulator Co.
Panascan, Inc.
Taller & Cooper, Inc.
Taylor Instrument Cos.
Tela-Computing Co.
Wianco, Inc.

"YOU'VE CHANGED—former classmates, L. Molique, Phillips, and F. Morgan, Texaco, meet after 19 years

"TIME OUT"—Earle Hoyle, Sinclair Refining Co., Ed Nopper, Sun Oil Co., and C. A. Taylor, Sinclair

"DON'T LOOK NOW, BUT"—E. R. Smoley, the Lummus Co., and Bonner Barnes, Gulf Oil Corp.

API Refiners Mark 25 Years

THE 20th mid-year meeting of the Refining Division, American Petroleum Institute, was also the occasion for celebrating the 25th anniversary of the Division.

Here are informal photographs of some of the hundreds of refining industry men who attended this year's sessions at the Jefferson Hotel, St. Louis, Mo., May 9 to 13. While these men were discussing mutual problems in refining technology, the officers of the Division were meeting and laying plans for future meetings.

The 21st mid-year meeting will be held in Montreal, Canada, May 14-17, 1956. Eleven sessions have been planned, covering the following subjects: analytical research, training, smoke and fumes, waste disposal, corrosion, electrical equipment, fuels and lubricants, processes, maintenance, and instrumentation.

Plans have also been made for the 22nd mid-year meeting. It is scheduled tentatively for Philadelphia, and will take place May 13-16, 1957.

"JUST BETWEEN US"—C. M. Liles, Magnolia Petroleum, and W. H. Lang, Esso Research and Engineering

"AT EASE"—N. Jaggard, Arabian American Oil Co., W. H. Claussen, California Research Corp., and W. J. Coppoc, The Texas Co.

"IN THE FIRST PLACE"—W. J. McLeod and George A. Davidson, both of Standard Oil of California

"IS THAT SO?"—Bob Cornforth, Kaiser Engineers, Roland A. Whealy, Ashland Oil Co., and Charles M. Ridgway, Pure Oil Co.

"CAN WE HELP YOU?"—Roxy Dowling and Lacey Walker, both of the API

"WHO ARE YOU KIDDING?"—Bill Gunn, API, Vance Jenkins, Union Oil of Calif., and George Watkins, Standard of Ohio

"THE WAY IT LOOKS TO ME"—W. W. Scheumann, Cities Service Research, R. M. Glover, du Pont

"CHIT-CHAT"—W. L. Webb, Standard of Indiana, H. K. Wheeler, Pan-Am Southern Corp., and W. S. Nordburg, Standard of Indiana

You CAN Standardize Maintenance . . .

Standardized maintenance at Atlantic Refining Co. means provision of Standard Practice Instruction manuals (SPI's) and Engineered Planning Times (EPT's) for the following factors:

1—Work methods

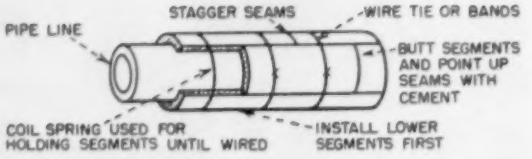
2—Work sequences

3—Tools and materials

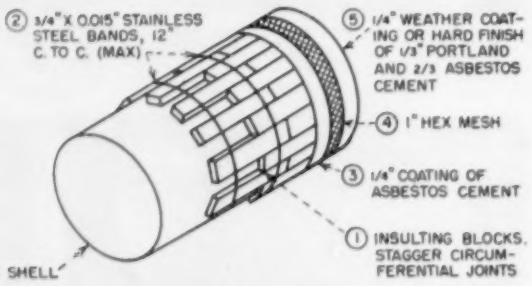
4—Standard forms for time values (man-hours) on both single and multiple craft jobs, to help estimating, planning, and work-load forecasting.

5—Auxiliary information to assist planning engineers.

Examples typifying some of these SPI's and EPT's are shown on these and following pages.


STAGGER SEAMS
WIRE TIE OR BANDS
PIPE LINE
BUTT SEGMENTS AND POINT UP SEAMS WITH CEMENT
COIL SPRING USED FOR HOLDING SEGMENTS UNTIL WIRED
INSTALL LOWER SEGMENTS FIRST

WORK METHODS—a graphic description of method of installing block insulation on a length of pipe


② 3/4" X 0.015" STAINLESS STEEL BANDS, 12" C. TO C. (MAX)
⑤ 1/4" WEATHER COATING OR HARD FINISH OF 1/3" PORTLAND AND 2/3 ASBESTOS CEMENT
④ 1" HEX MESH
③ 1/4" COATING OF ASBESTOS CEMENT
① INSULTING BLOCKS, STAGGER CIRCUMFERENTIAL JOINTS
SHELL

WORK SEQUENCE—installing insulation on a horizontal cylindrical vessel. Numerals indicate sequence. Illustration also shows work methods for the job

Standardized Maintenance Pays

- Reduced costs for turnarounds.
- More accurate forecasts on turnaround needs.
- Less overtime and fewer cases of unnecessary craft upgrading.
- Better forecasts of overall manpower requirements.
- Warnings of when specific crafts are overmanned.
- Simpler planning for vacations.

These are "profits" Atlantic Refining Co. gained when maintenance procedures, materials, and equipment were standardized. Taken altogether, they have meant a very real reduction in maintenance costs.

A target like this requires standardization, and maintenance operations *can* be standardized. Those who hold to the old belief that maintenance cannot be standardized will find labor measurement and regulation both difficult and expensive.

How can standards be applied? How do they work? Although it is true that

By FRANK O. PIERSON
The Atlantic Refining Co.
Philadelphia, Pa.

some of the conventional control techniques do not appear to work for maintenance costs, it will be shown here how standardization—with some adapting—has been made to work for Atlantic Refining at its Point Breeze, Penna., refinery.

What we have done may not be a ready-made solution to your own particular problem because of differences in equipment, size, products, plant layout, etc.; yet our experiences may help illustrate the basic principles which can be applied under any situation.

The Atlantic Refining Co. is an integrated oil company operating two refineries with a combined crude capacity of over 200,000 b/d.

The Point Breeze refinery—located in Philadelphia on a 650-acre plot at a bend in the Schuylkill River—is the larger of the two refineries. At Point Breeze, furnace oils, fuel oils, kerosines, gasolines, lubricants, waxes, chemicals and detergents are produced. This variety of operations naturally leads to extremes in operating conditions, all of which add to the complexity of maintenance.

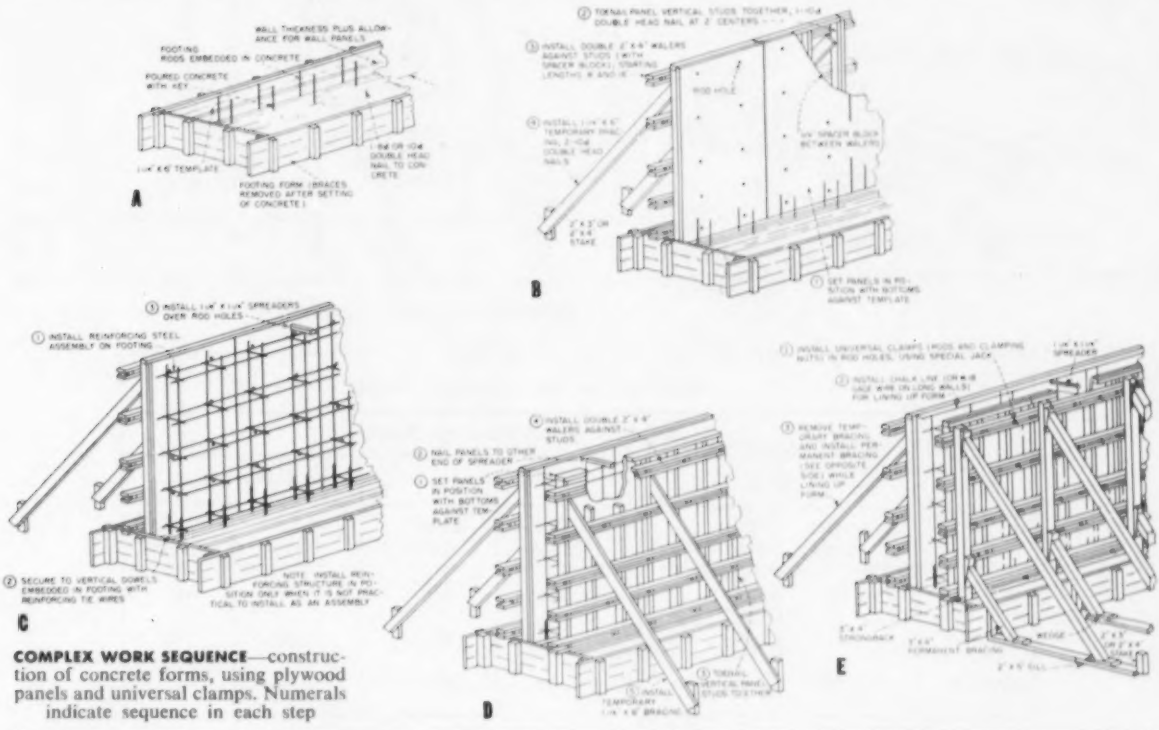
Maintenance activities—The mechanical department does most of our maintenance work. This department includes shop and field maintenance craftsmen, field construction craftsmen, instrument mechanics and a marine repair group.

Turnarounds account for about a third of all maintenance activities, requiring from 100 man days for a small unit up to 6000 man days for a big unit.

Despite good preventive maintenance, we have an occasional breakdown. These unexpected jobs are usually emergency jobs.

There is also a considerable amount

and Here's How Atlantic Has Done It



COMPLEX WORK SEQUENCE—construction of concrete forms, using plywood panels and universal clamps. Numerals indicate sequence in each step

of equipment repair work, as well as construction and rebuilding work. Whereas equipment repair is usually "hurry-up" such as in the repair of a pump while its standby is in operation, construction and rebuilding work can be postponed if higher priority work becomes pressing.

Some maintenance work is not done in the mechanical department. Resident mechanics, men always in the area in case of emergency, take care of short or special jobs such as packing pumps, lubricating engines, or making machinery adjustments, etc. These men are members of the operating force and get their orders directly from operating supervision with their time charged to a different maintenance code.

To maintain maintenance activities 24 hours a day, 7 days a week, our maintenance force includes about one-third of our refinery personnel. In the field mechanical force there are about 900 craftsmen.

Early Experiments and Why They Didn't Work

Atlantic has been interested in the control of maintenance costs for some time. The following describes one of our earlier experiments in the hope that others can profit from our past failures as well as our present successes. These experiences were valuable to us, helping us reach the present solution.

Wage incentives were used at first as maintenance control.

Wage incentive standards were developed by rate setters after the work was performed. The standards were expressed in small time units so that the rate setters could combine the standards into a job standard and also reflect the method actually used.

However, there were a few defects in this type of incentive. Although I think we were better off than plants not using labor measurements, these defects included:

- Development of the job standards required a close watch on job progress so that final standards reflected the methods used. This was an expensive procedure.
- For a variety of reasons we were not able to obtain complete coverage with standards.
- Craftsmen, and foremen, did not know what the target (or standard) was until after the job was finished.

Several years ago we took stock. We planned one rebuilding job in advance hoping to predetermine the method and give the workmen a target to shoot at. The job standards was 46 man days. It took a good rate setter 10 days to work out the details of the method, get agreements on the method, and compute the job standard time.

Although one sample is hardly representative, it did show us we would not get the control we wanted at a price we felt we could afford.

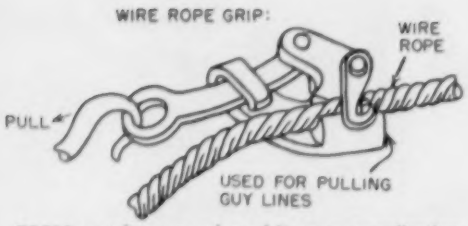
This sample job was important to us. It gave us a tool of self-examination. It helped us to examine critically each step of our program—past or proposed.

Evolving a Method

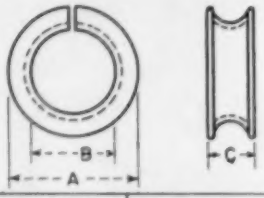
We started by laying out our objectives. We asked ourselves questions like:

- What do we need to know to be able to control maintenance cost?
- How much is it likely to be worth to know this fact?
- How can we use the knowledge after we get it?

We tried to set a clear-cut objective



TOOLS—a wire rope grip and its proper application



ROPE DIAMETER INCHES	OUTSIDE DIAMETER, IN. A	INSIDE DIAMETER, IN. B	DEPTH, IN. C
5/8	1 1/2	7/8	7/8
3/4	2	1	1
1 1/8	2 1/2	1 3/8	1 1/2

MATERIALS—materials and specifications for a ring thimble

O.D. of Shell, Head, or Flange (Feet)	MAN HOURS PER SQUARE FOOT					
	Heat Insulation and Weather Coating					
	Shell		Flat Head		Dished Head	
	One Layer	Two Layers	One Layer	Two Layers	One Layer	Two Layers
Up to 2	.35	.44	.50	.76	.76	1.0
2 to 6	.30	.37	.34	.46	.46	.60
Over 6	.26	.33	.25	.33	.33	.43

TIME VALUES—a unit time consolidation for insulating a horizontal cylindrical vessel

and design a program for reaching this objective.

Our basic objective was to control and reduce maintenance costs.

Reduction by deferment of maintenance is a temporary solution, but may not be desirable. Reduction by not doing unnecessary work is desirable. Reduction by using less costly methods is desirable. This latter also seems to be a worthwhile goal, so we tackled it first.

Less Costly Maintenance

It is evident that if we are to do maintenance work in a less costly way, we should have some measurement that would say:

- We are doing well,
- We are doing average, or
- We are doing poorly.

A target has limited value unless the worker knows what the target is before the job starts. Also a target for only part of the job has very limited value.

It looked like we were back where we started—ten rate-setter days to plan a 46-man-day job.

We considered alternatives. One idea was to set the target, assuming a good method—that is, any good method.

We could judge performance by how well the actual compared with the target, reflecting methods skills of the foreman as well as performance effectiveness of the craftsmen.

At first this looked reasonable. After a very short trial we could not find any maintenance foreman who thought it equitable. We became skeptical ourselves.

A well experienced planner could probably set standards with an understanding of the practical difficulties. A less versatile planner might select normally inexpensive methods that were impractical at this location, making a competent foreman look poor—or if the planner overemphasized the importance of some minor practical problems it might make a poor foreman look good.

We dug deeper. We examined our basic thinking, our fundamental concepts. We had already proven by our experience that we must standardize our maintenance method if we wanted to:

- Set a target in advance
- Set the goal by the method that would be used
- Set this target with a minimum of rate setter cost.

This defies the old philosophy that maintenance work cannot be standardized, but our whole standard practice program—which will be explained later—is proof that our work in maintenance is standardizable. In fact, standardization is the foundation of our program.

Some may continue to believe that maintenance is unpredictable, however those who favor the philosophy of preventive maintenance know that its success is based on predictions.

To believe maintenance is non-repetitive might mean that you are looking at the wrong pieces of work. We train welders with the knowledge that any ½-in. V-groove horizontal butt joint is like all others. When a welder can do one of them, he can do them all. We make a lot of these welds in a year's time.

We know now that we had some wrong concepts when we started. We think others may still have these ideas. Possibly these mental obstacles are one reason why progress in maintenance cost control has been slow.

Studying each facet of our experience, evaluating each problem en-

SPECIFICATIONS FOR INSULATION BANDS

For	Type of Insulation	Band Size	Approximate Feet Per Pound: Aluminum	Stainless
Pipes	Mag. or H.T.	3/8" x 0.010"	----	80
		3/8" x 0.020"	100	----
	Cork	3/4" x 0.010"	----	----
		3/8" x 0.015"	----	80
Vessels	Mag. or H.T.	3/4" x 0.015"	----	25
	Cork	3/4" x 0.015"	----	----
		3/4" x 0.020"	----	25
			----	19

Supplied in coils 17 1/2" O.D. x 6" I.D. or expendable self dispensing cartons of 200' coils.

AUXILIARY INFORMATION (above) — to help planners, foremen, and pipe insulators obtain proper type and quantity of supplies they need

MAN HOURS PER DERRICK

Mast Height (Feet)	By Gin Pole		By Crane	
	Erect	Dismantle	Erect	Dismantle
60	149	115	113	79
50	138	106	102	70
45	134	102	98	66
40	131	100	95	64
35	126	95	92	59
25	121	88	85	52

Planning Tools Include:

Assemble mast sections.
Assemble boom sections.
Assemble leg sections.
Erect gin pole (where used).
Erect mast.
Rake gin pole and erect legs (where gin pole is used).
Anchor sill.
Anchor legs and mast to sill.
Erect boom.
Remove gin pole (where used).
Install blocks and falls.
Reeve lines.
Install bull wheel or bull stick.
Run out wire rope to winch.
Set up winch.
Site travel.
Preparation and clean up.

Planning Times Do Not Include:

Obtain derrick parts.
Mobile equipment operator.

TIME VALUES (left)—a big-job consolidation, for erecting and dismantling a stiff-leg derrick by two methods

countered, and working out a remedy to solve each problem made it obvious to us that standardization of maintenance labor also meant standardization of materials, tools, equipment, procedures, etc.

Therefore our standardization program resulted in a set of Standard Practice Instruction (SPI) manuals specifying work methods, work sequence, materials, tools, etc.

Big Ones from Little Ones

We still didn't have the target—in industrial engineering terms—the standard. We had cut one of the biggest items out of the cost of developing the target—getting agreement on the method.

Using small time values for compiling the target standard had cost us a lot of money. We found that standardization of methods, work sequence, tools, materials, equipment, etc., made it possible to develop big time units. We could make time units as big as we wanted. We often made them up in several different combinations to reduce clerical cost at the job planning phase.

The big time values we called Engineered Planning Times (EPT's). As fast as the Standard Practice Instructions (SPI's) were finished, we developed EPT's to match.

We were now ready to put our show on the road with these SPI's and EPT's covering almost every type of maintenance and construction work normally done at the Point Breeze refinery. These laid the groundwork for making effective the basic philosophies that shaped our program to the following point of development:

- The job will be planned according to the proper method. The target time will then be developed before the work is started.
- We will not be satisfied with scanty coverage. We want complete coverage.
- The cost of the control program including development must be less than the benefits from its use.

The industrial engineering phase of this program ends here. We have standardization and work measurement tools available.

Next came the application of effective control—or how to use the tools of SPI's and EPT's.

Management's interest in these tools is to use them to save money, reduce plant operating expenses, and use maintenance dollars in the most effective way.

Full collaboration with our mechanical department was practiced in the development of SPI manuals and EPT time values. For instance, the welding SPI's represented the opinions of the mechanical technical group, mechanical inspection department, maintenance and construction foremen skilled and experienced in welding work, and others.

While the welding SPI's represented the combined thinking of our most qualified personnel, no single foreman was familiar with all of these methods. Some of the craftsmen did not know or practice the prescribed methods. Our planners were not completely familiar with all of the SPI agreements.

Training the Personnel

Our first step toward control was to train the key people and the first class craftsmen, as standardization is of little value unless it is followed in practice.

We first analyzed the scope of our plant work by craft. Each type of craft

job was listed down the side of a big sheet of paper (this is done for each craft in turn).

Across the top of the sheet we listed the names of the first and second class craftsmen and the craft helpers. Then the foremen, who knew these men best, tabulated the level of the individual craftsman's knowledge by job detail. If the man was fully trained, one mark. If he needed more practical experience, but not training, another type of mark. If he was unskilled but able to be trained, a third mark. If he was incapable of absorbing training (too near retirement to be justifiable, physically handicapped, etc), another mark.

From this sheet we found how much training was required and in what detail.

The industrial relations department prepared the necessary training manuals from the SPI's. The craftsmen, less versatile job foremen, and the planners were then trained in whatever detail necessary.

Foremen and planners were trained in the use of the EPT's. Key foremen were given the opportunity to field test each EPT they wished to evaluate. In fact, we tried to get every EPT tested at least once by a competently supervised field trial.

This part of the training—the cooperative effort—has made acceptance of the EPT values one of the outstanding characteristics of this program.

This paper sounds as if we were doing all this sequentially. Actually, work progressed concurrently. We would write an SPI. As soon as it was finished, the training people would start on the training program, we'd start on the EPT's, and also start another craft SPI.

Job Scheduling

A planning organization was being built up at the same time. We experimented with organization, procedure and various work separations. The planning group was finally organized in a way that minimizes clerical and overhead cost and obtains all the controls our management required.

Work orders are divided into three basic types. One type includes short jobs, illustrated by Mechanical Orders (MO's), and most Job Orders (JO's) which are sent to the planning clerk. MO's and JO's are planned by the zone planning engineer as fast as possible after their receipt. By this order system we strive to eliminate doing unnecessary work.

Another type of work order includes authorizations of large capital or replacement projects. These are planned by a special group skilled in this type of work.

Turnarounds are repetitive authorizations and are planned by a third group. The original turnaround plan is worked up by a group of industrial engineers and planners. Subsequent turnarounds are prepared by the specialized planning group.

About 70% of the orders are short MO's or JO's amounting to less than 5 man days of work. These, however, amount to only 6% of our man day work load.

Because of the partnership arrangement in developing the SPI's and EPT's, our planners and craft foremen have developed a better than average estimating ability. With one or two years experience working up job standards, these men are now able to estimate these short jobs quite accurately. If in doubt they still work out the EPT in detail. This move has made it possible to reduce the number of planning engineers in each of the five zone officers from three to one. Longer jobs are always worked out in detail.

The first job of the planning engineer, regardless of the type or size of the order, is to find out exactly what is wanted. This might be adequately described on the work order —might require a telephone call to the originator—or might require a trip to the unit to see the work. The engineer makes a sketch if necessary, recording the essential measurements, etc.

If a short job, craft types required are listed and the man days or hours for each craft estimated. After discussion and approval, this order has been "planned."

Larger jobs are worked up in the Zone Office. SPI methods are listed; tool, equipment and material requirements computed; EPT work allowances posted and the job blocked out, that is, craft sequence and timing plotted.

A big job, such as an authorization or turnaround is a collection of relatively independent jobs. For instance, on a turnaround the tower work, the exchanger work, furnace work, pump work, etc., are each set up as individual jobs.

Planned jobs are discussed with the zone foreman. He may accept the plan unchanged, or may suggest changes in over-all concept, equipment selection, etc.

When agreement is reached, the zone foreman signs the plan and puts it in his pending job file. The copy is sent to the work control central office. This group obtains from the manager's office the priority rating for this job, and computes the scheduled backlog of work by crafts.

This priority planning gets "hot" jobs done first—counteracts the old attitude "the squeaky wheel gets the oil."

Planning next week's work, the craft requirements are listed for the top priority jobs. This continues until we run into shortages of craftsmen in one or more crafts. These jobs are again listed, together with their craft requirements, by zone.

This roughed-out schedule is reviewed with the top mechanical department supervision. If acceptable, it then becomes the following week's work schedule.

Since the normal zone complement of craftsmen rarely matches the scheduled manning for priority jobs in each zone, there must be some transfer of manpower. Arrangements are made to transfer the required personnel (craftsmen and foremen) from home zone to work zone.

A lower priority listing is made of fill-in jobs for craftsmen not used in the above schedule. The zone and job foremen distribute the remaining craftsmen as effectively as possible on phases of these lower priority jobs.

Although the schedule lists top priority and fill-in jobs, it does not specify sequence. It lists what we consider desirable manloading, but this is not mandatory.

The zone foreman pulls the priority jobs from his file, and with his job foreman, schedules the actual assignment of men. They also determine the assignment of left-over craftsmen to the fill-in jobs.

In the planner's office is a material man. He works on the original planning sequence, computing materials, tool and equipment requirements. He finds out delivery dates for special material, available dates for special equipment, etc. while the priority schedule is being developed.

When the job is released for work, it is the material man's responsibility to make certain that materials, tools and equipment are at the job site before the job foreman assigns the men to the job. He must get the zone foreman to realign job sequence if for some reason the necessary materials, tools or equipment did not reach the job site on schedule.

The job foreman directs the job. He meets unexpected circumstances by on-the-job adjustment. If more work than anticipated is found necessary, he notifies the zone planning engineer. The job plan is amended and work allowance added for the new work. Additional manpower is assigned if

advisable or necessary. Work deletions follow the same pattern, but in reverse.

Checking Results

Actual work accomplishment and manpower use is observed and reported by the planners on the big turnarounds and authorizations. The plans are, as stated before, broken down into jobs, each job is further broken down into phases.

Review by phase makes it possible to keep an up-to-date running record of progress compared with schedule, manloading compared with schedule, and manpower effectiveness.

Meetings are held daily in the superintendent's office to review these developments. Corrective steps necessary to speed up a lagging job, improve manpower utilization or replan a program are promptly taken.

Small jobs are reported when completed. It is possible to obtain a lot of good control data from three comparative figures. Manloading (man days of measured work planned) by days; manpower actually used and measured man days of work completed. This last figure includes phase completion of big jobs, total completion of small jobs.

Manpower actually used versus manpower scheduled can reveal whether zone foremen are concentrating the effort according to priority listing—or between authorization work and maintenance.

Work accomplished against work planned shows whether accomplishment is spread according to management's desire.

Work accomplished compared to manpower used shows how effectively manpower is being used. There may be effective utilization of the manpower, with improper distribution of effort; or proper distribution, but ineffectual use of the men.

These ratios are reported by the central work control group. They may be compiled by zone, by foreman or for the entire department. Schedule effectiveness or manpower effectiveness can be determined for any job.

System Advantages

This completes the outline of how the control system works on a week-to-week basis. A few other advantages are obtained from the accurate numbers this system provides.

Turnaround schedules are laid out a year in advance. The operating departments and the inspection department know pretty accurately how many operating hours each unit can run before a turnaround should occur.

Authorizations are also future commitments, some of them extending several years in advance.

Running records of MO and JO needs give us a good statistical outlook on the volume of this work.

We are able to make a good forecast of manpower needs a year in advance by craft. This is excellent budget preparation material. This provides long advance warning of overmanning by craft. Craft shortages that will develop can be forecasted early enough to permit training and upgrading helpers and second-class mechanics at an unhurried but scheduled pace.

Vacation planning is greatly simplified. The men desire middle of the summer vacations. We can forecast which week we can safely schedule maximum vacations, when we should restrict or refuse vacation requests. Considering the low turnover in our mechanical department and the fact we give three weeks vacation after 15 years service and four weeks after 25, this is a big help.

The cost results to date are quite satisfactory.

Reductions of 20-25% in total man days of work have been shown in recently completed planned turnarounds compared with past average. In addition, recent turnarounds have been completed without upgrading of men or overtime. In the past it was common practice to upgrade craftsmen to fill certain specialized crafts, and to permit considerable overtime.

Elimination of upgrading and overtime improves the cost picture. There has been but one recent turnaround where we had to permit overtime in order to get the job done on schedule. On this job we encountered manpower shortages from the start. One emergency followed by another emergency robbed us of manpower avails. As though this wasn't enough, we ran into two days of very bad weather.

I want to stress the cooperative element of our work. Industrial engineers tend to ask for—but not give—cooperation in the true sense. Too often we try to tell the operating people how to run their job—how we would do it if it were our responsibility.

Atlantic's entire industrial engineering staff adopts the idea that the maintenance man is running this show—it's his job. We are a staff department—he has problems—we are there to help him solve his problems. We are going to do our helping his way—even if we think we know a better way.

The experience of our people has shown that the wrong way is never permanent. Whenever the mechanical department people find any way is wrong they will change it.

All of the industrial engineers at Atlantic have learned the value of patience. They have learned that for us true cooperation works. Without this ingredient, Atlantic's program of reducing maintenance costs would not be the success it is.

Our main contribution as industrial engineers at Atlantic is that we have helped the mechanical department solve their problem. But its successful application is due to them—their efforts—their desire to save Atlantic money.

The preceding article is an adaptation of the paper "Control and Reduction of Maintenance Costs" presented by Mr. Pierson at the 10th Anniversary joint conference of the Society for Advancement of Management and the American Society of Mechanical Engineers held April 28-29, 1955, in New York City.

Meet the Author

Frank O. Pierson is Chief Manufacturing Industrial Engineer for The Atlantic Refining Co. He holds the degree of Bachelor of Science in Engineering Administration from M.I.T. Mr. Pierson has followed Industrial Engineering work since his graduation, working for the International Paper Co., General Motors Corp., and E. I. du Pont de Nemours & Co. Following the war, he went into consulting work, becoming manager of the New England area for Kenneth A. McIntyre Associates. He joined The Atlantic Refining Co. in 1948 as Chief Process Industrial Engineer, and was advanced to his present position the following year. Since 1950 he has been devoting a considerable portion of his time to developing various controls of maintenance costs. A member of the Engineers Club of Philadelphia, he is the author of a number of technical articles, primarily in the Industrial Engineering field.

A PANEL OF PROCESSING TECHNOLOGISTS* who bring you with the aid of a wire recorder . . .

Technical Tips on
Petroleum Processing Problems

What conditions tend to increase CO-CO_2 ratios on catalytic cracker regenerator flue gas? What is the highest CO-CO_2 ratio that anyone has experienced? At what ratio was most coke burned?

Norris: You've got to tie something down as a constant. I assume the ratio to mean in any one unit where you're not at liberty to add more air to the plant, and assuming most people have excess air, your oxygen concentration doesn't become a factor. Temperature is probably the only variable. The higher the temperature, the more CO you can get on a given catalyst. The other variable you will find by experience in the catalyst itself. Synthetics produce more CO than naturals.

The statement of the question is in inverse ratio from the way we normally talk about it. We normally talk about it with CO_2-CO. In those conditions, it's two or three parts CO_2 to one part CO on natural. That's affected by temperature primarily. And, as I say, always considering that oxygen is probably in excess, the chances are that those ratios will be found fairly constant. Now, oxygen-deficient conditions are another matter. I'm not sure you will get much experimental data that will prove anything, one way or another. The CO data we have gotten from plants has always been highly erratic. I think it is because the determinations are not always very good.

Eckhouse: I think we should refer the questioner first to the minutes of last year's meeting. There were about three pages devoted to this question, and it was really very complete.

Basically, the problem I believe is how to utilize a given amount of air most efficiently. The CO_2-CO ratio is, in effect, a measure of your air utilization per lb. of carbon burned. As this ratio increases, you will burn less coke per lb. of air at the same excess air oxygen content. Of course, that's axiomatic. Ordinarily, we try to maintain a low CO_2-CO ratio in order to maximize utilization of air. Normally, as the temperature increases, the CO_2-CO ratio decreases. The type of catalyst is another important factor. Natural catalysts tend to give a higher ratio than the synthetics. After-burning will normally result in higher CO_2-CO ratio, and thus a high ratio may be a symptom of after-burning.

Brown: The activity level may be an important factor too.

Eckhouse: Yes, as the activity decreases, the CO_2-CO ratio increases. Also, the carbon on the coke is another factor. As you lay down more coke on the catalyst, the ratio will tend to increase.

Feasel: Air distribution through the grid has a large bearing on that, in my own experience. Also contributing are catalyst particle size and ultimate fluidization. We are presently using the air heater at 700 to 800° F. in order to improve grid differential and improve burning characteristics.

From floor: **Would raising the bed level help any?**

Feasel: Raising the bed level is something I don't like to do if I can avoid it. I like to operate at a minimum inventory in order to hold addition rates down. By putting on the air heater I was able to reduce the carbon level from 1.5% down to about 0.3%.

What has been done when running into pressure balance limitations between reactor and regenerator, where it is not advantageous to raise or lower the pressure of one or the other?

Edwards: Change the catalyst level.

Feasel: In my own case, we ran into some reactor difficulty—essentially the same thing. When you get an upset condition there, about all you can do

* Left to right: Parker, Eckhouse, Norris, Rippie, Heike, Brown, Feasel, Gearhart, and Wilson. (Edwards was not present for the picture.)

is raise the regenerator level to offset it. That's good up to a point, and from there on, it's not much help.

What is the experience of Fluid operators relative to after-burning in the regenerator? What are critical factors —what limits might be set on regenerator temperature and oxygen content of the flue gas?

What provisions are made relative to installation of thermocouples between cyclone stages to detect after-burning?

Can cyclone after-burning be effectively controlled by introducing steam into the regenerator cyclones between stages?

Edwards: The only thing I can say on the first question is that we try to control the oxygen content below 1% in the flue gas.

Eckhouse: We would normally try to keep the oxygen content of the flue gas below about 0.5%. We like to keep regenerator temperatures down below about 1130° F., although actually the maximum to which you can go is limited by the metal in the regenerator, within the ordinary range that we're operating.

The problem of after-burning is, of course, associated with problems such as air utilization and contact of air with the catalyst. Certainly particle size is important, and also the carbon level on the catalyst. Ordinarily, if we get into after-burning, we would prefer to reduce the air flow to control it, though we use water sprays as well.

Brown: Most after-burning in my experience generally follows an upset. In that case, the carbon level builds up, and as it burns off, you have no oxygen for a period. Then the oxygen level rises. The only way we've been able to get out of this difficulty is to spray water into the regenerator. Steam has not been found effective. We have two units which have separate thermocouple arrangements. Where possible, a thermocouple in the plenum chamber and between cyclones would be helpful. We do not have this. We have to rely on dilute phase and stack temperatures to detect after-burning. We have been able to detect it though, and control it very well.

Edwards: At Borger, Texas, we have such a high catalyst carryover from the cyclones that we found it uneconomical—in fact, almost impossible—to control after-burning by a water spray. In this respect, we differ from most of the others who have been successful in using water spray.

What maximum regenerator bed temperature might the several Fluid unit operators set and how are these temperatures maintained?

Feasel: We do it by increasing or decreasing carbon laydown.

Brown: We run from 1100 to 1125° F. We do some control by circulation rates on the unit where we have a furnace, but it's much harder to do on a heat-balance unit. We have less control on the regenerator temperature. It varies from about 1100 to 1150° F., and 1150° is what we try to call the maximum.

Eckhouse: I think if catalyst circulation and carbon laydown is controlled within the limits, then we would normally recommend somewhere around 1130° F. although, of course, quite a few units do run higher.

What is the experience of the several Fluid unit operators relative to the catalyst-to-oil ratio, based on fresh feed vs. gasoline yield, gasoline quality and product distribution? This would be at a total-to-fresh feed ratio of 1.5.

Considering all factors, what is preferable: a high or low catalyst-to-oil ratio, and why?

Eckhouse: It's probably true, that as the catalyst-to-oil ratio increases, carbon laydown at the same conversion will tend to increase. On the other hand, it's our philosophy in designing units to keep them simple, and to minimize investment and operating costs. The catalyst-to-oil ratio in a heat balance unit is really not an independent variable but rather is a function of heat balance. If you want to make it an independent variable, then you have to get into feed preheat, catalyst coolers, and that sort of thing. We don't believe, at least on the smaller units, that it is economical. It just complicates the operation and you don't gain enough to offset the primary advantage of somewhat lower carbon laydown.

Feasel: Recycle ratios above 1.5 contribute very little. Actually, I never like to exceed about 1.45. I think that right in there somewhere is the maximum—at least the optimum we should use. Beyond that, I think we're just circulating catalyst, and less contributing to the wear and tear of the units. I think you can achieve severity in other ways.

Ten Experts Answer Your Process Questions

This article is the fifth in a series which began in the March issue, pp. 366-369, providing answers from ten authorities in their fields on a complete range of petroleum processing problems.

Like a similar series we were pleased to present last year, this material is based on a popular day-long session at a regional meeting of the Western Petroleum Refiners Ass'n in El Dorado, October, 1954. It was obtained by means of a wire recorder by PETROLEUM PROCESSING's editors.

Wide experience was represented by the panel of authorities—five from refining companies and five from suppliers or engineering firms. The moderator was E. A. Heike, chief engineer, Premier Oil Refining Co., Ft. Worth, Texas, who filled the same role in the panel the year before.

The refining group included: J. M. Brown, assistant manager of operations, Pan-Am Southern Corp., El Dorado, Ark.; R. E. Feasel, supervisor of fuels manufacturing, Deep Rock Oil Corp., Cushing, Okla.; J. A. Gearhart, process engineer, American Liberty Oil Co., Mt. Pleasant, Texas; and R. S. Wilson, chief chemist, Lion Oil Co., El Dorado, Ark.

The engineering group consisted of: J. G. Eckhouse, sales engineer, Universal Oil Products Co., Des Plaines, Ill.; O. D. Edwards, sales engineer, Perco Division, Phillips Petroleum Co., Bartlesville, Okla.; D. E. Norris, commercial development engineer, Houdry Process Corp., Philadelphia, Penna.; F. D. Parker, western manager, Blaw-Knox Co., Tulsa, Okla.; and C. W. Rippie, president, Electric Process Co., Summit, N. J.

This month's article continues the discussion of questions pertaining to catalytic cracking begun earlier, and includes questions on treating. Other subjects to be covered in forthcoming issues will include reforming, corrosion, and miscellaneous plant problems.

Norris: Our experience on that I think would differ. I would be a little bit at odds with you on total-to-fresh feed ratio. We have demonstrated recycle ratios of at least as much recycle as fresh feed; in fact, with over 90% conversion operations. On our units, of course, we don't have quite the same situation as on heat balance units. On our operating units, our catalyst-to-oil ratio is 4 or 5. On the newer units, it may be as high as 6. The range for moving bed units extends from a top ratio of 6 for Houdriflow units down to a ratio on our older types of about 1.5 or 2. We can't really detect any appreciable change in good product distribution within those limits.

Has anyone found a good distillate fuel oil stabilizer that does not form or promote haze when the product is cooled to 32°F?

What is the trend in distillate fuel quality as regards the end point, sulfur, and stability?

Eckhouse: Universal Oil Products Co. has a stabilizer on the market now, as most of you know, called Driacin. We also have another stabilizer which will soon be out, which will improve the stability of fuel oil. However, the problem of haze in fuel oil is more nearly associated with water inclusion. If you have that problem, the first thing to do is to remove the water by conventional means. This might be by drawing water on the furnace oil tanks, by using salt filters or sand filters, or something of that nature.

from floor: **This stabilizer which inhibits precipitation, of course will also stabilize colors?**

Eckhouse: Yes, it will in some cases stabilize the color. Storage stability also is improved. There is also a very marked trend in distillate fuel manufacture toward utilization of hydrogen from reforming processes to hydrogenate these distillates and upgrade their quality. There has been considerable published information during the last year on the "Unifining" process, which is a new catalytic hydrogenation process which will produce a superior fuel from just about every standpoint. It improves both color and color stability. It removes sulfur and it reduces the bromine number. Of course, the initial units are working on the borderline, or poorer, fuels in order to upgrade them to present quality; but the trend in the future will be toward improving all of the distillates by means of hydrogenation.

Who Were the Experts?

E. A. Heike, Premier Oil Refining Co.
J. M. Brown, Pan-Am Southern Corp.
R. E. Feasel, Deep Rock Oil Corp.
J. A. Gearhart, American Liberty Oil Co.
R. S. Wilson, Lion Oil Co.
J. G. Eckhouse, Universal Oil Products Co.
O. D. Edwards, Phillips Petroleum Co., Perco Division.
D. E. Norris, Houdry Process Corp.
F. D. Parker, Blaw-Knox Co., Chemical Plants Division.
C. W. Rippie, Electric Process Co.

What is the maximum mercaptan content of cracked gasolines which may be inhibitor sweetened?

Rippie: A number of gasolines have been treated, say as low as 0.001 or 0.002, I think economically. But above that point, the cost may be of the order of $10 or $15 per 1000 bbl. I would like to comment on the effect of hot caustic soda on inhibitor demand, such as inhibitor sweetening, caustic steam regeneration, or regenerated Doctor solution. Some 15 years ago, Ashland Oil & Refining Co. built one of the first steam caustic regenerators to treat Dubbs cracked gasoline. Then, later, the caustic was regenerated by an electric process. The copper dish normally was lower. The inhibitor bill was reduced about 75%. Most of this inhibitor was used to finish up the residual treatment of about 0.001 to 0.0015% mercaptan sulfur in the treated stock.

Now, I well realize that most stocks are stable, but a lot of the treating processes have made them unstable. For instance, caustic soda solution treatment of sour stocks will extract certain organic compounds. Later, the spent caustic solution is heated, and these organic compounds convert into a polymer, like a resin. This resin dissolves in the gasoline on the recyle operation, and consumes inhibitor. Such treating processes increase the inhibitor demand. The larger inhibitor demand was due to the treating process and not due to the unstable gasoline.

C. R. McMahan (UOP): I am afraid I will have to disagree a little. In the first place, we are well aware that many gasolines should not be inhibitor sweetened. We think we know which of those gasolines we are talking about. On the other hand, the majority of the catalytically cracked gasolines produced today and for the past several years have been quite effectively, efficiently, and cheaply inhibitor sweetened.

In discussing inhibitor sweetening, we are not trying to replace treating plants by large quantities of inhibitor. I rather like to have my cake and eat it too. I want to use enough inhibitor to acquire the stability properties necessary to make a good, storage-stable gasoline. If I can acquire inhibitor sweetening at the same time, I am very interested in inhibitor sweetening.

Fortunately, practically all catalytic gasolines produced are low in mercaptan sulfur—generally being under 0.01 wt.-%. Most of those gasolines can be, and most of them are, effectively inhibitor sweetened. Everyone has his own rule-of-thumb. I happen to be a 5 lb./1000 bbl. man myself, which figures out to about 6¢/bbl. on inhibitor cost.

from floor: **Can you quote a figure on mercaptan content?**

McMahan: No, I can't. I will say that I am interested in anything under 0.01%. Quite effectively, there are many at 0.008 that I don't want to inhibitor sweeten. I differentiate between thermally cracked and catalytically cracked: cat cracked being much easier and nicer to handle. Many of the thermal gasolines actually go to hydroperoxides and you destroy stability as you inhibitor sweeten.

from floor: We have successfully treated heavy cat naphthas and intermediate cat naphthas of 0.0015 wt.-% mercaptan content, ranging from 3 to 8 lb./1000 bbl. of oil. We have had no difficulty as long as we did not try to move gasoline too fast. There is a relationship between storage time and when we use the inhibitor.

What effect does the addition of sodium carbonate have on diethanolamine solution in a Girbotol unit? (Sodium carbonate is added to release the inactive form of heat-stable diethanolamine-acidic salts.) Do these acidic salts (oxalic acids) have any effect on the diethanolamine?

Edwards: The problem involved is formation of fixed amine salts, such as amine oxalate, by the reaction of the diethanolamine. They tie up the DEA and do not break down to permit

amine regeneration. Sodium carbonate replaces the amine salt to form the sodium salt, thereby freeing the amine. The sodium salt then can be removed and reclaimed by simple distillation.

Rippie: The process has a determination for the presence of sodium thiosulfate generated from the oxidation of absorbed hydrogen sulfide. Once sodium thiosulfate gets into the solution, its activity as an absorbent is greatly reduced. Without a doubt, the Girdler process of diethanolamine absorption has been the best regenerative H_2S process in the world. Several hundred plants have been built using this principle.

Several months ago in Texas, Oklahoma, and Kansas I found Girdler plants shut down and up for sale. Investigation of the process revealed the solubility of diethanolamine in liquid gasoline was of the order of some 40 lb/1000 bbl., or 30¢/lb., or $12/1000 bbl. Last month, at the Western Petroleum Refiners' Association meeting in Casper, Wyo. (Sept., 1954), Oliver Zandona of Ashland Oil & Refining Co. and I described briefly an amine salt solution for the removal of H_2S from liquid poly feedstocks. Recently, Stanolind Oil & Gas Co. showed that their Girdler unit operating costs were 50% due to corrosion and 31% due to loss of ethanolamine solvent. This made up a total of 81% of their total operating costs attributed to the shortcomings of the solvent.

One week ago yesterday, Ashland Oil & Refining Co. started up a converted Girdler plant at Buffalo, N. Y., using the amine salt for removal of H_2S from a liquid poly feedstock. I have a sample taken out of the plant. The amine salt has reduced corrosion and makeup losses, compared to diethanolamine solution.

Amine salt is a solid, and very water-soluble. The diethanolamines are liquids, and distill out overhead in the recovery of the spent solution. It is very important to keep the amines away from the sulfuric acid catalyst in order to get good life out of the catalyst. This is the first time we have mentioned a commercial plant operation of the amine salt process. The amine salt process will reduce chemical costs and avoid pollution caused by waste caustic solutions being drained into the public rivers and lakes.

Eckhouse: I might mention the use of a water wash ahead of the Girbotol unit to remove the organic acidity. I think that has been reported by Pure Oil. It prevents the formation of nonregenerable salts in the amine system.

The acids present in the particular case cited—a gas feed Poly unit—were propionic and acetic, both stronger acids than H_2S. By using a water wash ahead of the Girbotol unit and keeping only enough caustic in there to maintain neutral exit water, they were able to take out the organic acidity and considerably improve the amine problem. They would get into a situation where the whole system would set up in a gel, and it would be necessary to dump the entire system. By that time, the addition of sodium carbonate or sodium hydroxide was too late.

Feasel: We have a Girbotol unit and have some of the same problems you mentioned. We have handled this problem by installing a filter in the line. Using a filter aid and passing all the DEA solution through this filter, we have been able to eliminate most of the insoluble salts.

from floor: We also have a filter. However, the filter plugs up and our hot DEA-to-cold-DEA exchangers plug up at the same time.

Feasel: We have not had any of that trouble. Normally, without any upsets on the unit, the filter probably will have to be changed once every 24 hours.

from floor: **Just where is that filter located? Upstream from the regenerator?**

Feasel: All DEA from the units to the regenerator passes through the filter. The filter aid is Kieselguhr.

What is the optimum strength of caustic for pre-washing straight-run naphthas for hydrogen sulfide, naphthenic acid, and aliphatic acid removal? What would the answer be for light catalytic naphtha? Is recirculation desirable if 2 to 4° Be. caustic is used?

Has anyone had gel formation in caustic pre-washes of naphthas? How was this resolved? (The gel apparently is about a 50-50 mixture of hydrocarbon and water.)

What is the optimum acid-oil content of regenerated caustic without emulsification and carry-up?

Rippie: Whatever remarks I make about caustic soda may at times be in favor of it and at times be against it. I usually take the side of the refinery, that the least caustic soda you buy the less you have to dump. Government regulations restrict waste caustic disposal, as Giles of Indiana Standard pointed out at the WPRA annual meeting last year.

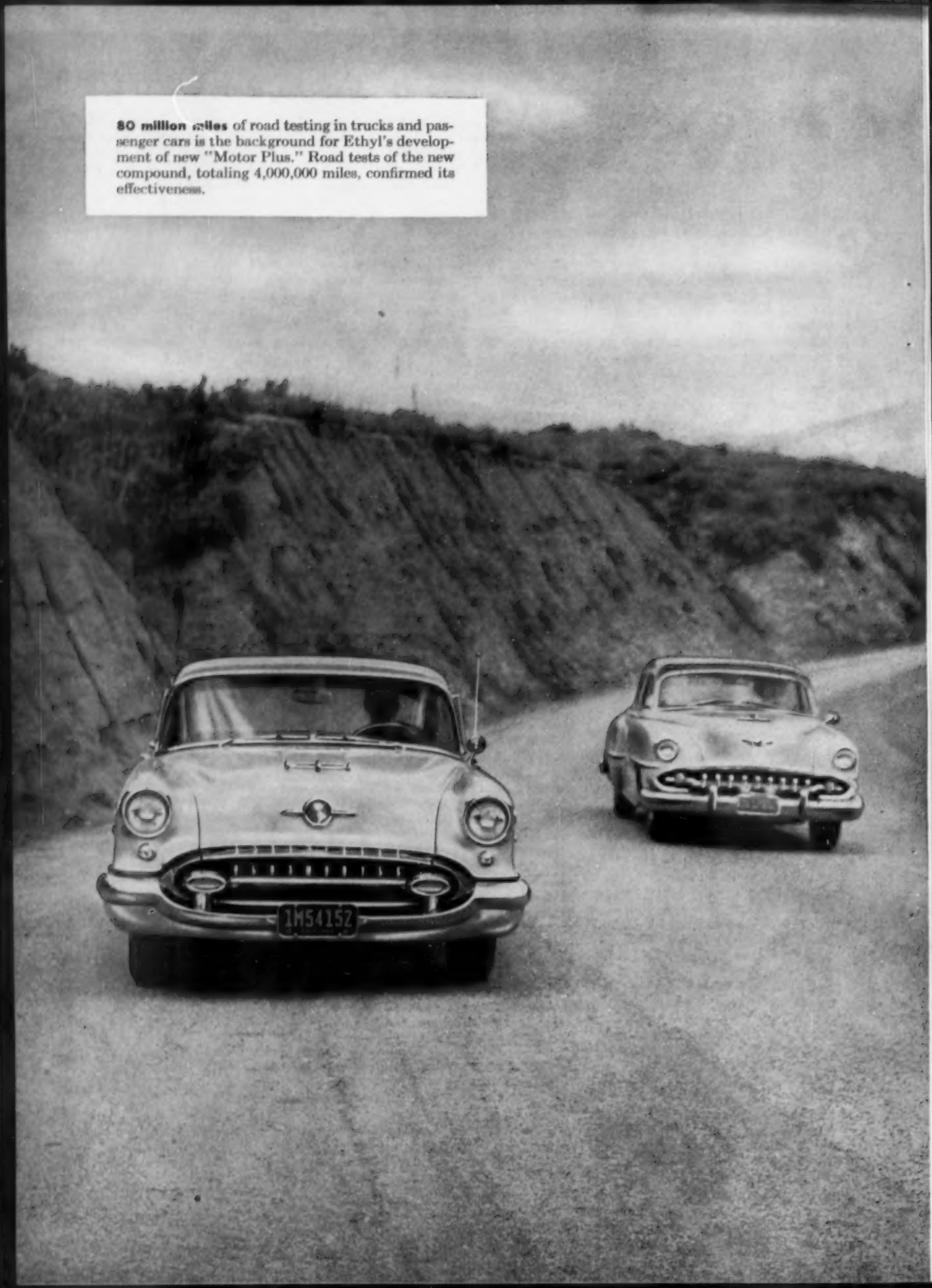
The recirculation of 2 to 4° Be. caustic solution depends upon what type of mercaptan is removed. I have known some operations where that was the most desirable. However, the volume was quite large. and necessitated larger equipment and more frequent changing of the solution. This brought about greater labor costs, so the refiners doubled that concentration and reduced the number of barrels of waste solution.

Regarding gel formation, it is interesting that sodium sulfide in 25° Be. sodium hydroxide forms a hydrate with water—nine molecules of water. This hydrate will set up and will plug a pipe line solid. If you want to ship a 40° Be. caustic, then the problem is how to use a 40° Be. caustic to avoid this hydrate. Some plants have started with a 20° Be. caustic solution and then added 5° Be. caustic hydrate.

On the question of the optimum acid-oil content of regenerated caustic without emulsification: I would like to bring to your attention part of a WPRA paper we presented at Casper, based on plants in operation at Ashland and at Leonard refineries. I showed a sample of caustic that has treated 10 million bbls. of gasoline, and at no time has emulsion ever developed.

Now this problem of foaming, emulsions, and carryover is certainly part of any steam regenerative system. I have observed about 100 of those plants around the industry. It costs money to make these acid oils. The cheapest and best way for the refiner, is to leave the acid oils in the gasoline. Cabal of Socony Mobil published a very important paper in PETROLEUM PROCESSING in July, 1954 ("New Test Unit Shows Gum Not Only Factor Affecting Gasoline Stability," A. V. Cabal, pp. 1044-1047), showing that thiocresols were responsible for high ASTM gum. Leonard Refineries, Inc., has found that regenerating the caustic cold meant obtaining low ASTM glass dish values. They have extracted thiocresols and left 1000 b/d of normal cresols in the gasoline, selling them at refinery gasoline prices. Leave the acid oils in the product; they save on inhibitor and labor.

I well recognize that a flue-gas regenerator became popular for a time in the industry and did a very good job. But today, stream pollution authorities are watching for phenols in very small concentrations.


80 million miles of road testing in trucks and passenger cars is the background for Ethyl's development of new "Motor Plus." Road tests of the new compound, totaling 4,000,000 miles, confirmed its effectiveness.

New antiknock formula test-proved by Ethyl Research

Ethyl's new MOTOR PLUS the result of many years of work in developing improved antiknock compounds

Thirty-three years of supplying gasoline additives have taught us one fact that is perhaps the most important of all:

An antiknock compound must keep pace with all the developments in engines, fuels and lubricants. Since "Ethyl" fluid was first sold, Ethyl research has developed seven major improvements in fluid formulation to meet changing requirements in fuels and engines. The recently developed "Motor Plus" is the eighth.

Advantages to refiners

Ethyl's new "Motor Plus" offers you an improved antiknock compound which will control knock and, at the same time, lessen the problems of octane requirement increase, preignition, and combustion chamber deposits.

Our road and laboratory tests show that the new formula offers you these advantages:

Engine deposits are reduced—up to 12% (by weight).

The effects of deposits are reduced—
Knock reduced—up to 18%.
Surface ignition—up to 25%.

Exhaust valve life is increased 35%.

Extensive test background

To test-prove the effectiveness of our new formulation, we set up an exhaustive testing program eighteen months ago. Using engines of representative types, we tested the new "Ethyl" compound for 2,500,000 truck miles and more than 1,250,000 passenger car miles. In addition, we tested it in the laboratory for more than 10,000 engine hours. All tests confirmed the value of this formula in engines on the road today.

Research on antiknock compounds

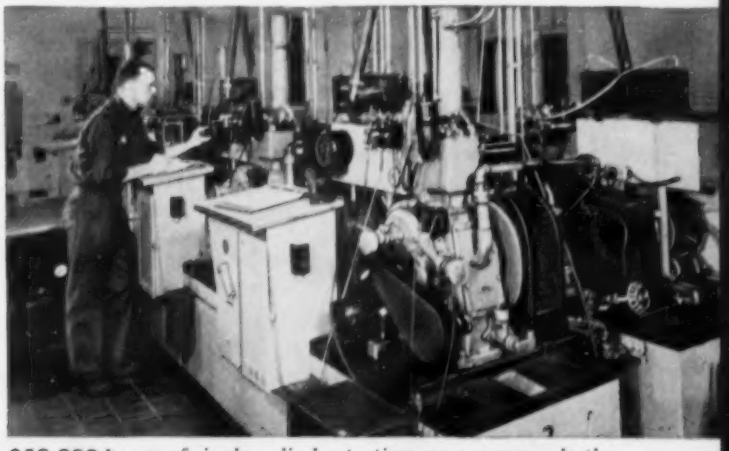
Good as this new Ethyl formula is, our extensive research program continues in order to bring to the petroleum industry antiknock compounds that are best suited to the engine-fuel-lubricant environment of the future.

For more information about Ethyl's new antiknock compound see your Ethyl representative. He will be glad to provide the details.

ETHYL CORPORATION
Research Laboratories

1600 West Eight Mile Road, Ferndale 20, Michigan
2600 Cajon Road, San Bernardino, California

500,000 total hours of testing antiknock fluids on multicylinder engines preceded the development of Ethyl's new "Motor Plus."



350,000 hours of single-cylinder testing gave our people the necessary background to develop Ethyl's new antiknock formula. Several thousand hours were devoted to the proving of "Motor Plus" alone.

That's the long-life valve on sulphuric acid

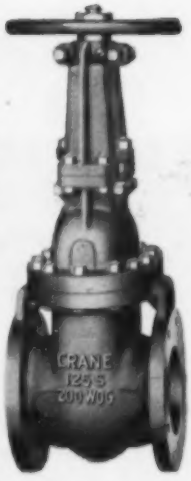
THE CASE HISTORY: At a large midwestern refinery there were recently two valves of different makes on a 90% sulphuric acid line. As seen in the photo above, these valves worked under identical conditions, almost side by side—each operated about three times daily.

Less than a year in the line, the valve at left started leaking, with the leak getting rapidly worse. In contrast, the Crane No. 475½ all-iron gate valve at right, with two years' continuous service to its credit, was still giving completely good performance.

That's Crane quality in valves—with a 100-year background in quality manufacturing. That's why Crane valves are the first choice of thrifty buyers in the petroleum industry as in all others. Crane Co., General Offices, Chicago 5, Ill. Branches and Wholesalers serving all industrial areas.

CRANE IRON BODY WEDGE GATE VALVES

Here are valves of unusual strength for their 200-pound W.O.G. rating. Body and bonnet are oval shaped, with extra metal where needed most. Their Crane-quality cast iron with highly engineered operating design makes these valves outstanding performers wherever they're used. A complete family to choose from. See your Crane Catalog or your Crane Representative.



CRANE CO.

VALVES • FITTINGS • PIPE
KITCHENS • PLUMBING • HEATING

CRANE'S FIRST CENTURY...1855-1955

Petroleum Processing

JULY 1955

Petrochemical Section

IN THIS SECTION

ACETYLENE
A Challenge to the Petrochemical Industry
—pp. 1011-1023

- how much is needed? —p. 1012
- how will it be used? —p. 1014
- how will it be made? —p. 1016
- how is it handled? —p. 1020
- what about the future? —p. 1022

. . . and You Takes Your Choice
Many acetylene sources offered processors—p. 1022

In the Departments

Here's a method of installing a water draw-off fitting on a gasoline tank without taking the tank out of service—(Plant Practices) p. 1027.

New catalyst comprising co-precipitated elements and how it compares in heat tests with more conventional types—(Patents) p. 1039.

OTHER DEPARTMENTS

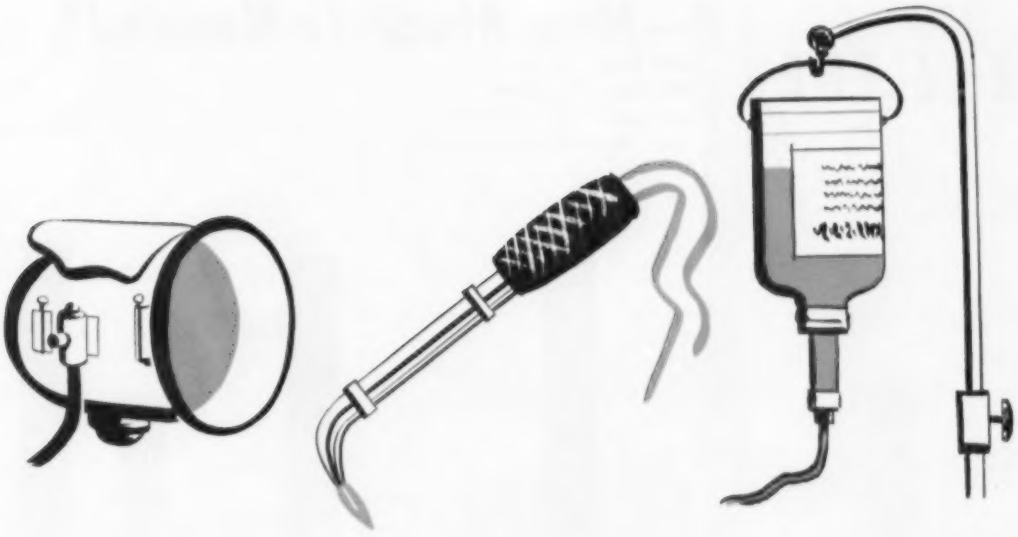
Personals 1033
Suppliers 1047
Meetings 1033
Information Offered 1054
Advertisers' Index 1056
What's New 1057
Editorials 1058

GOING PLACES *is always easier with Cities Service...*

Helpful directions to travelers on major turnpikes is just one small reason why the green-and-white emblem renews its welcome daily.

CITIES SERVICE
A Growth Company

Number 10 of a series



ACETYLENE

1—How much will be needed?	2—How will it be used?	3—How will it be made?	4—How will it be handled?	5—What about future trends?

A Challenge to the Petrochemical Industry

By MARSHALL SITTIG
Larchmont, N. Y.

ACETYLENE is truly a chemical in transition. Not only are dramatic changes taking place in the ways it is being used, but also in the raw materials and processes for making it.

Acetylene uses have progressed from the gas lamps of the '90's (practically passe)—through the welding and cutting torch (still an important, but minor, use)—to the role of chemical intermediate (for plastics, rubbers, fibers, and the like). Symbolic of the use of acetylene today (and tomorrow) as an intermediate is one of its newest derivatives — polyvinylpyrolidone, or synthetic blood plasma.

These newer markets aren't necessarily promised to acetylene, however. Many of the end products can be made just as well from ethylene.

Raw materials and manufacturing processes for making acetylene likewise are changing. Traditionally, acetylene has been made from calcium carbide and water; the carbide has been made in turn from limestone and coke (either petroleum or coal). Today, a variety of hydrocarbon cracking processes are in strong competition with the carbide process and with each other for top position as an economic source of tomorrow's expanding acetylene requirements.

The petroleum industry will gain in any event —through sales of ethylene in competition with acetylene, of hydrocarbons for making acetylene, or of petroleum coke for carbide.

But to take maximum advantage of the profit opportunities in acetylene, petroleum processing plant engineers, operators, managers need to make careful analyses of many questions:

1—How much will be needed?
2—How will it be used?
3—How will it be made?
4—How will it be handled?
5—What about future trends?

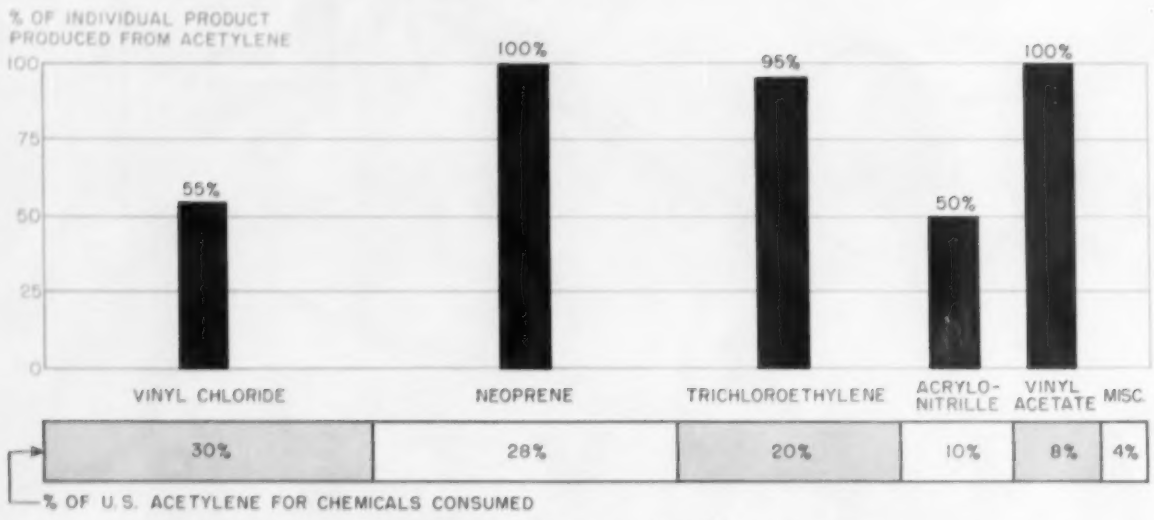
Here, for the first time and presented in summary form in the following five articles, is the complete picture of "Acetylene—A Challenge to the Petrochemical Industry!"

A 12-PAGE REPORT ►

ACETYLENE

1—How Much Is Needed?

2—HOW WILL IT BE USED?
3—HOW WILL IT BE MADE?
4—HOW WILL IT BE HANDLED?
5—WHAT ABOUT FUTURE TRENDS?



BIG USERS OF ACETYLENE, these important chemicals are a key to . . .

HISTORICALLY, acetylene found primary use as a fuel gas and in welding and cutting. This use has changed from the major one to a minor one as acetylene-derived chemicals have grown in importance.

The amount of acetylene which will be needed for these chemical uses is a function of two things: 1) the size of markets for acetylenic end products, and 2) the possibilities of making those end products from other, more-attractive raw materials.

The primary competitor for acetylene in chemicals manufacture is ethylene, as outlined by Guthrie.[1] In many cases, chemical end-products may be made from acetylene in a single step, whereas manufacture from ethylene may require going through an intermediate, with an additional process step. However, ethylene from ethane or propane cracking may be available at 4.0 to 6.5 cents/lb., compared to acetylene at 7.0 to 11.0 cents/lb. As pointed out by Ruebensaal in 1952,[2] ethylene had 40% the unit value of acetylene and consumption of ethylene was five times as great as acetylene. By 1975, the balance is still expected to be 3.5:1 in favor of ethylene.

As pointed out by Blaw-Knox,[4] ethylene has been sold at the plant in the past 12-18 months for from 1.5 to 5 cents/lb. This same report indicates that current long-term commitments are at 3.5 to 5 cents/lb., the 3.5 cent price at Gulf coast locations and the 5 cent price in other areas.

The major chemical uses of acetylene and the possibilities of alternate production from ethylene are summarized in Table 1. The relative importance of these various consumers of acetylene is shown in the charts.

In the case of vinyl chloride, a close balance has apparently been struck, at present price levels, between acetylene and ethylene, since 45% of present capacity is based on ethylene and 55% on acetylene.[8]

The ethylene-based processes for vinyl chloride have been described in detail by Blaw-Knox Co. in a recent report.[4] Either a thermal process or a caustic process may be used, starting with ethylene dichloride in either case.

In the thermal process, dried ethylene dichloride is fed to a direct-fired heater where it is cracked at 900-950° F. to vinyl chloride and hydrogen chloride. Conversion of 50%, vinyl chloride yields of 96%, and a vinyl chloride production cost of 7.51 cents/lb. by this route are cited.[4]

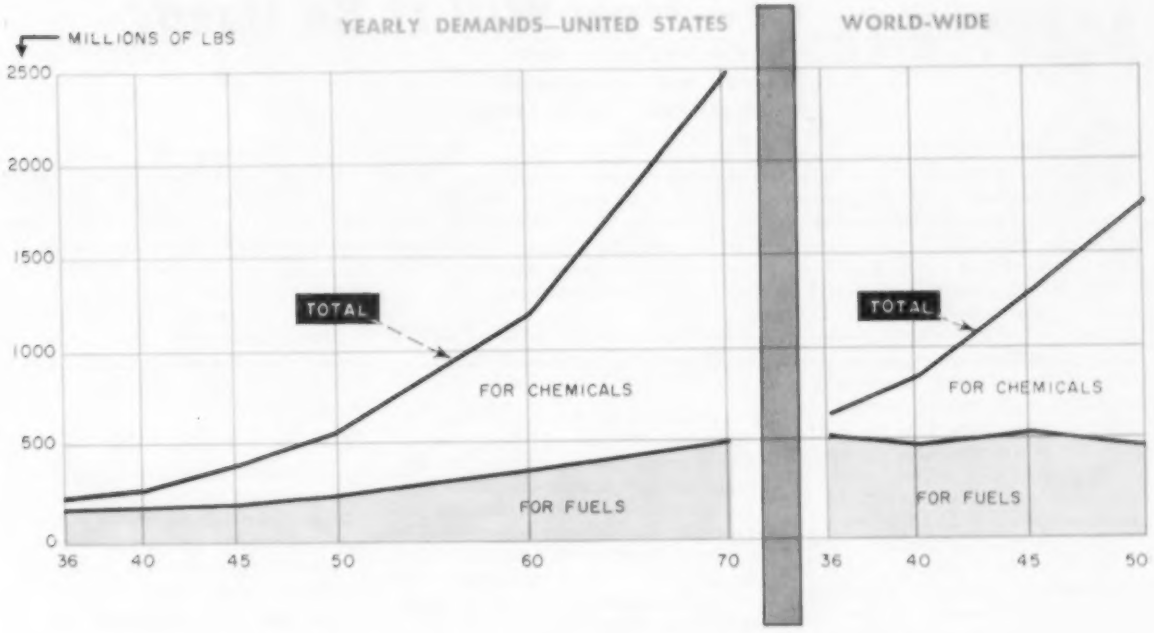
In the caustic process, a mixture of two mols of ethylene dichloride and one mol of 6% sodium hydroxide are heated to 290° F. under pressure for a contact time of 2-3 minutes, giving 90% conversion to vinyl chloride and a yield substantially quantitative.

Vinyl chloride production from all sources has jumped from 75 million lbs. in 945 to 300 million lbs. in 1950, and is expected to hit 800 million lbs. in 1955, Ruebensaal.[2]

For neoprene, no alternate route using ethylene exists. Neoprene production is now about 150 million lbs. annually. Neoprene manufacture, which began on a small scale at Deepwater, N. J., in the 1930's, has since been transferred entirely to Louisville, Ky., where it has expanded to its present impressive status as a close competitor for the largest single consumer of acetylene.

Almost all of the trichloroethylene manufactured in this country is made from acetylene. Some small amount is presumably made from ethylene chloride as a by-product of ethylene glycol manufacture. Trichloroethylene capacity has been steadily growing, and has risen from 277 million lbs. in 1951. Trichloroethylene consumption for 1955 has recently been estimated at 330-340 million lbs., with over 90% going to metal degreasing.

As to acrylonitrile, as pointed out by Ruebensaal,[2] either 0.5 lbs. of acetylene or 0.8 lbs. of ethylene oxide are required. Since ethylene oxide costs 50% more than the most expensive acetylene, the acetylene route has the edge on the basis of raw material cost alone. However, two items of purification cost make the ultimate cost of acrylonitrile from acetylene higher—these are purification costs for hydrocarbon acetylene and the more complex purification required for acryloni-



THE GROWING DEMAND FOR ACETYLENE, current and future years (see note)

trile made from such acetylene. Also, the fact that ethylene oxide facilities are now in existence, nearer many markets, and partially depreciated, will provide rough competition for acetylene for some time to come.

Total acrylonitrile production is expected to increase from 20 million lbs. annually in 1950 to 300 million lbs. annually by 1955, according to Ruebensaal.[2] In 1953, only 6% of the acrylonitrile produced was made from acetylene, but this amount is expected to exceed 50% by the end of 1955.[5] Total production of acrylonitrile by 1955 has been more recently estimated at 190 million lbs.[5]

Vinyl acetate is made exclusively from acetylene. In 1949 polyvinyl acetate production was 21.3 million lbs. In addition, a considerable quantity of vinyl acetate is copolymerized with vinyl chloride. Polyvinyl acetate is also the starting material for polyvinyl alcohol, formal and butyral. Vinyl acetate is used in resins, emulsions and soil conditioners.

Acetaldehyde creates a complex relationship between acetylene and competing raw materials. Aside from the competition afforded by ethylene, via the ethyl alcohol route, acetaldehyde may be the product of any one of various other processes:

1—Manufacture of butadiene from alcohol.

2—Manufacture of acetic anhydride from ethylidene diacetate.

3—Direct hydrocarbon oxidation.

4—Fischer-Tropsch process.

Studies by Aries and Cziner[6] have shown, however, that acetaldehyde can be made without loss from acetylene when the price of acetylene is not more than 111% of the price of acetaldehyde. These authors have also shown that acetaldehyde can be made without loss (via ethanol) from ethylene, when the price of ethylene is not more than 71% of the price of acetaldehyde. The acetylene process also requires less capital investment.

As pointed out by Ruebensaal,[2] total acetaldehyde production increased 100-fold between 1930 and 1940. A further increase of 40% between 1940 and 1948 brought total production to 600 million lbs./yr.

NOTE: Figures for 1955 were not available when chart was prepared. Recent U.S. Dept. of Commerce report indicated U.S. demand in 1955 for fuel to be about 150 million lb.; for chemicals, 400 million lbs.; and total 550 million lbs.

Table 1—Major Chemical Uses of Acetylene and Possible Alternate Routes from Ethylene

Product	Acetylene Route	Ethylene Route
Vinyl chloride	Direct HCl addition	Direct thermal chlorination or Cl_2 addition, HCl removal
Neoprene	Acetylene to monovinylacetylene to chloroprene to neoprene	None
Trichloroethylene	Chlorine addition to give tetrachloroethane, followed by dehydrochlorination	As a by-product of ethylene glycol manufacture, by way of ethylene dichloride.
Acrylonitrile	Direct HCN addition	Oxidation to ethylene oxide, followed by HCN addition, dehydration.
Vinyl acetate	Direct acetic acid addition	None
Acetaldehyde	Direct H_2O addition	Hydration to ethyl alcohol, then dehydrogenation to acetaldehyde.

How Will It Be Used? — — ▶

ACETYLENE

1—HOW MUCH IS NEEDED?
2—How Will It Be Used?
3—HOW WILL IT BE MADE?
4—HOW WILL IT BE HANDLED?
5—WHAT ABOUT FUTURE TRENDS?

ASIDE from questions of competition between acetylene and ethylene, it is important to consider in detail the processes which consume acetylene as shown in Fig. 1.

The largest consumer of acetylene today is the manufacture of vinyl chloride.[7] Dry hydrogen chloride gas and dry acetylene are mixed in a ratio of 11 moles/10 moles. Moisture is excluded to hold down by-product acetaldehyde formation. The gas mixture is passed to a multitubular reactor, the tubes packed with carbon pellets impregnated with mercuric chloride. The reactors operate at 280-400° F.

The raw reaction products go to a stripper where unreacted HCl and acetylene are recovered. Stripper bottoms are fractionated to give vinyl chloride as the overhead product and ethylidene dichloride and acetaldehyde as by-products. The vinyl chloride product is finished by a caustic wash, then the addition of phenol as a polymerization inhibitor, before storage in stainless steel tanks.

The second largest user of acetylene today in chemicals manufacture is neoprene synthetic rubber.[8] In the manufacture of neoprene, acetylene is first converted to monovinylacetylene, the dimer of acetylene, as shown by the equation:

$$2HC{\equiv}CH \rightarrow HC{\equiv}C{-}CH{=}CH_2$$

and the vinylacetylene is then reacted with hydrogen chloride to give 2-chloro-1,3-butadiene (chloroprene)

$$HC{\equiv}C{-}CH{=}CH_2 + CHl \rightarrow H_2C{=}C(Cl)CH{=}CH_2$$

Chloroprene is the monomer from which neoprene rubber is made by emulsion polymerization.

The polymerization of acetylene to monovinylacetylene is the acetylene-consuming step in neoprene manufacture and hence is of most pertinence here. It is carried out at low temperature (45-100° C.) and low pressures (essentially atmospheric) by contacting the acetylene with an acid, aqueous solution of cuprous chloride and potassium chloride. Two molecules of acetylene combine to form monovinylacetylene (MVA) for the most part; to a lesser degree, three molecules of acetylene combine to form the trimer, divinylacetylene (DVA) which is burned. Unreacted acetylene is separated from the reaction products and recycled.

Trichloroethylene is the third largest chemical end use for acetylene.[9] This material is produced by the reaction of acetylene with chlorine to form tetrachloroethane, which is then dehydrochlorinated to trichloroethylene as shown by the following equations:

$$HC{\equiv}CH + 2Cl_2 \rightarrow CHCl_2 \cdot CHCl_2$$
$$2CHCl_2 \cdot CHCl_2 + Ca(OH)_2 \rightarrow 2CHCl{=}CCl_2 + CaCl_2 + 2H_2O$$

In carrying out the first of these two reactions, chlorine and acetylene are fed together into an agitated reactor, constructed of plain steel, and containing tetrachloroethane as the reaction medium. Excess tetrachloroethane is removed from this first reactor as it is formed, and without additional purification necessary, is sent to a reactor where the second step reaction shown above is carried out.

A 10% lime slurry is used in this dehydrochlorination step. A tower top temperature of 200° F. allows trichloroethylene to distill overhead. Trichloroethylene can also be produced by thermal cracking of the tetrachloroethane at 1100° F. or by catalytic cracking (over a barium chloride catalyst) at 450 to 600° F. In any event, the crude trichloroethylene from this dehydrochlorination reaction is purified by fractional distillation and then stabilized.

The fourth chemical use for acetylene in terms of 1955 markets is acrylonitrile (vinyl cyanide). The direct synthesis of acrylonitrile from acetylene and hydrogen cyanide is carried out under reaction conditions very similar to those used in the acetylene polymerization (MVA manufacturing) step in neoprene manufacture—temperature, pressure and catalyst are very similar—the only major difference is the presence of HCN. About 9 moles of gaseous acetylene are fed to the reactor for each mole of liquid HCN introduced.

The reactor is a rubber-lined cylindrical vessel containing an aqueous solution of cuprous chloride, hydrogen chloride and alkali chlorides. It is a dense solution, containing only about 36% water, but all of the salts are dissolved at the reaction temperature of 175° F. The reactant gases are bubbled beneath the surface of the catalyst solution and are maintained under only enough pressure to maintain circulation in the system. The catalyst is withdrawn and regenerated after 1-2 months of operation.

As in MVA manufacture, small amounts of acetaldehyde and vinyl chloride are produced (from the water and the HCl in the catalyst solution). In acrylonitrile synthesis by this process, MVA is also produced as a by-product. However, acrylonitrile is produced in 80-85% yield, calculated on acetylene fed and in 90-95% yield, calculated on HCN fed. The main reaction is simply

$$HC{\equiv}CH + HCN \rightarrow CH_2{=}CHCN$$

Sherwood[10] states that the acrylonitrile produced by this direct synthesis is very pure (above 99.9%) and is more reactive in polymerizations than is acrylonitrile produced from ethylene by the cyanohydrin route.

The fifth most important use for acetylene as a chemical intermediate is in vinyl acetate manufacture. Acetylene can be added directly to organic acids in the presence of catalysts, according to the general reaction:

$$HC{\equiv}CH + RCOOH \rightarrow RCOOCH{=}CH_2$$

Production of esters of high molecular weight acids requires higher acetylene pressures and higher temperatures than those required for vinyl acetate manufacture. Mercuric sulfate is used as the catalyst in vinyl acetate manufacture, according to Shreve.[11]

A newcomer to commercial synthesis from acetylene, but one worthy of special mention here is the synthesis of acrylic esters from acetylene, carbon monoxide, and alcohols in the presence of nickel carbonyl. This is the first instance of large-scale application of an adaptation of one of the Reppe processes in this country. The general reaction is as follows:

$$HC{\equiv}CH + CO + ROH \rightarrow CH_2{=}CHCOOR$$

The Rohm and Haas process operated at the new Houston, Texas, plant[12] employs mild reaction conditions, the pressure being atmospheric and the temperature 30 to 50° C.

Another chemical which is made from acetylene is acetylene black. This form of carbon black is made by the decomposition of acetylene under closely controlled conditions, and is sold at a premium price (as carbon blacks go) for dry cell batteries, and for the compounding of electrically-conductive rubbers. Acetylene black production is concentrated in Canada.

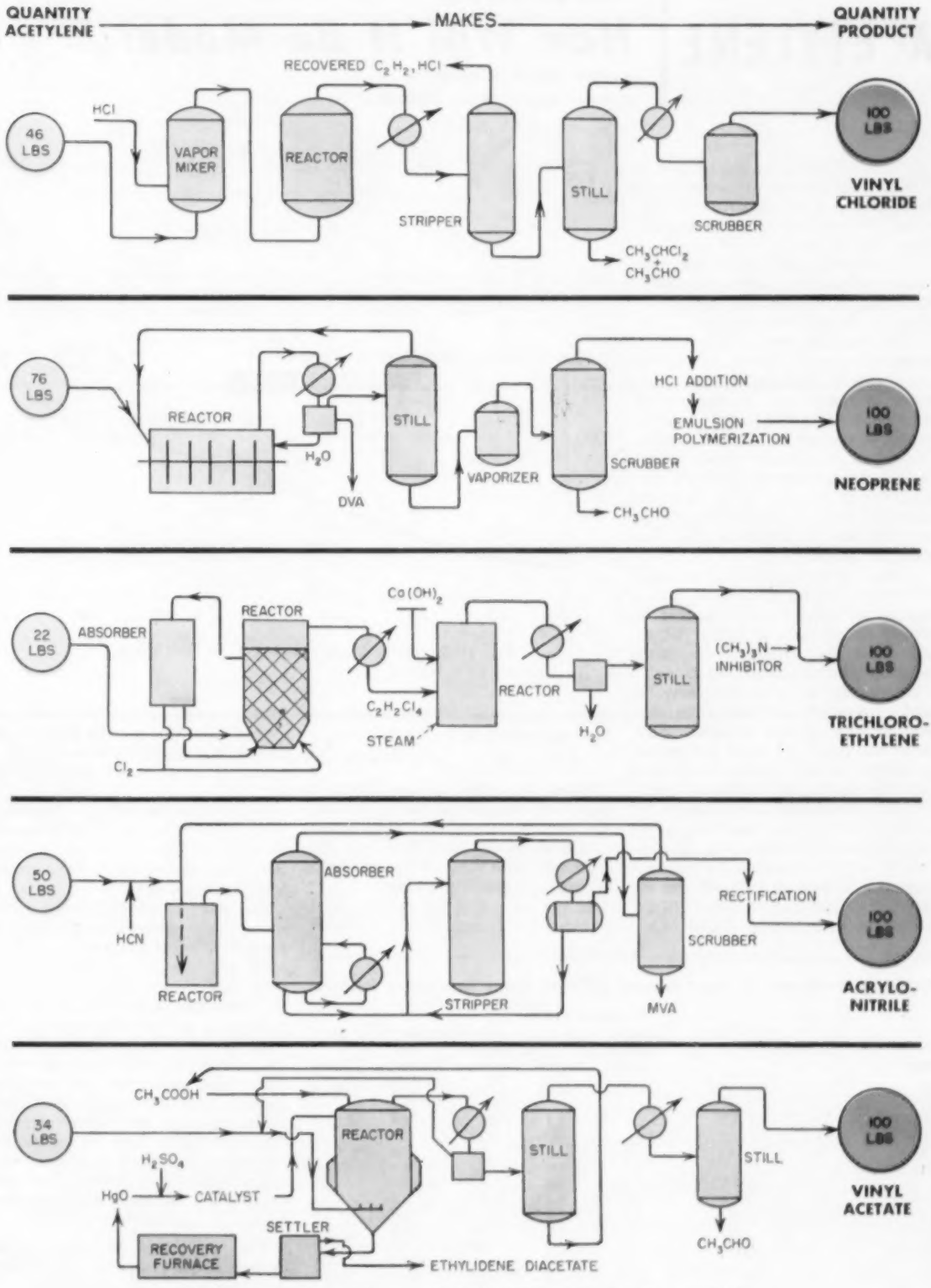


FIG. 1—Pounds of acetylene required per 100 pounds of various products

How Will It Be Made? — — ▶

ACETYLENE

1—HOW MUCH IS NEEDED?
2—HOW WILL IT BE USED?

How Will It Be Made?

4—HOW WILL IT BE HANDLED?
5—WHAT ABOUT FUTURE TRENDS?

ACETYLENE is made by one of two fundamental processes—from the reaction of calcium carbide with water—or from the cracking of petroleum hydrocarbons.

The classical method has been the reaction of calcium carbide with water according to the reaction:

$$CaC_2 + 2H_2O \rightarrow Ca(OH)_2 + C_2H_2$$

This reaction can be carried out by dropping nut-size chunks of carbide from special hoppers directly into water in a generator. A dozen such hoppers, holding five tons of carbide apiece, fit snuggly into special gondola cars. These hoppers are transferred by traveling cranes directly from the railroad cars to the tops of the acetylene generator feed screws (usually on the opposite side of a firewall from the generator proper).

About one gallon (8.3 lbs.) of water is used per pound of carbide. Water flow to the generator is regulated to control temperature at about 70° C. and dilute lime sludge is constantly removed through an inverted U-leg.

Alternately, a dry process may be used to generate acetylene from carbide. In this process variation, only about one pound of water per pound of carbide is used and it is sprayed onto the carbide in a rotating drum. Careful temperature control must be practiced to prevent acetylene polymerization and decomposition. In contrast to the wet process, a dry calcium hydroxide is produced, which can be recycled to carbide furnaces.

Calcium carbide is produced in an electric furnace where lime is reduced by coke according to the reaction:

$$CaO + 3C \rightarrow CaC_2 + 3CO$$

Petroleum coke is the preferred source of carbon[3] because of its low ash and high resistivity. Coke from coal is also widely used, however, and constitutes over 90% of the coke used in carbide manufacture today.

In the event that the carbide plant is located adjacent to the chemical plant consuming the acetylene, the carbon monoxide may be piped to the chemical plant for the manufacture of methanol, acrylic esters, Oxo products, etc.

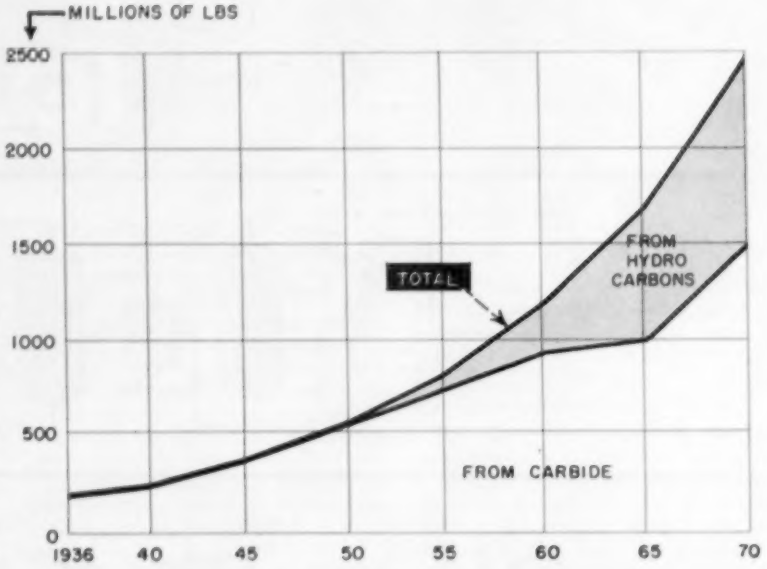


FIG. 2—Sources of U. S. acetylene ((see note below)

Fig. 2 shows the relative importance of carbide and of petroleum as sources of acetylene and emphasizes the strong trend toward acetylene from petroleum hydrocarbons.

The page opposite this one shows some of the salient characteristics of the four different processes for making acetylene. In each case, the acetylene-producing reactor, which is the most important and distinctive part of each process, is shown schematically. The yield figures given are merely indicative and show approximate hydrocarbon consumption in the cracking methods as well as approximate coke consumption in the carbide process. The exact yields from the various hydrocarbon cracking processes vary rather widely with hydrocarbon feed composition and with such operating factors as hydrocarbon recycle.

The cracking of petroleum hydrocarbons is the newer process, of high

(Continued on page 1018)

NOTE: Recent U. S. Dept. of Commerce figures indicate the 1955 total for acetylene from carbide to be nearer 500 million lbs., due to operation of carbide facilities considerably under capacity.

Table 2—Analyses of Feed to and Effluent from Acetylene Process

	Production Units				
	Feed	Effluent Gas			
Mol-%	Natural Gas	Schoch	Oxygen Oxidation	Air Oxidation	Wulff
H_2	....	42.2	51.3	24.3	61.4
N_2	....	....	1.6	54.2	....
CO	....	2.1	26.3	9.4	3.5
O_2	....	....	....	....	....
CH_4	84.3	39.2	5.8	3.6	22.6
CO_2	4.3	1.0	5.9	3.5	1.5
C_2H_2	....	9.9	8.5	3.5	9.0
C_2H_4	....	0.5	0.1	0.2	0.9
C_2H_6	6.8	2.2	....	1.0	0.2
C_3H_4[a]	....	0.7	0.4	0.2	0.5
C_3+[b]	4.6	2.2	0.1	0.1	0.4
	100.0	100.0	100.0	100.0	100.0

[a] Includes heavier acetylenes.
[b] Includes heavier paraffins and olefins.

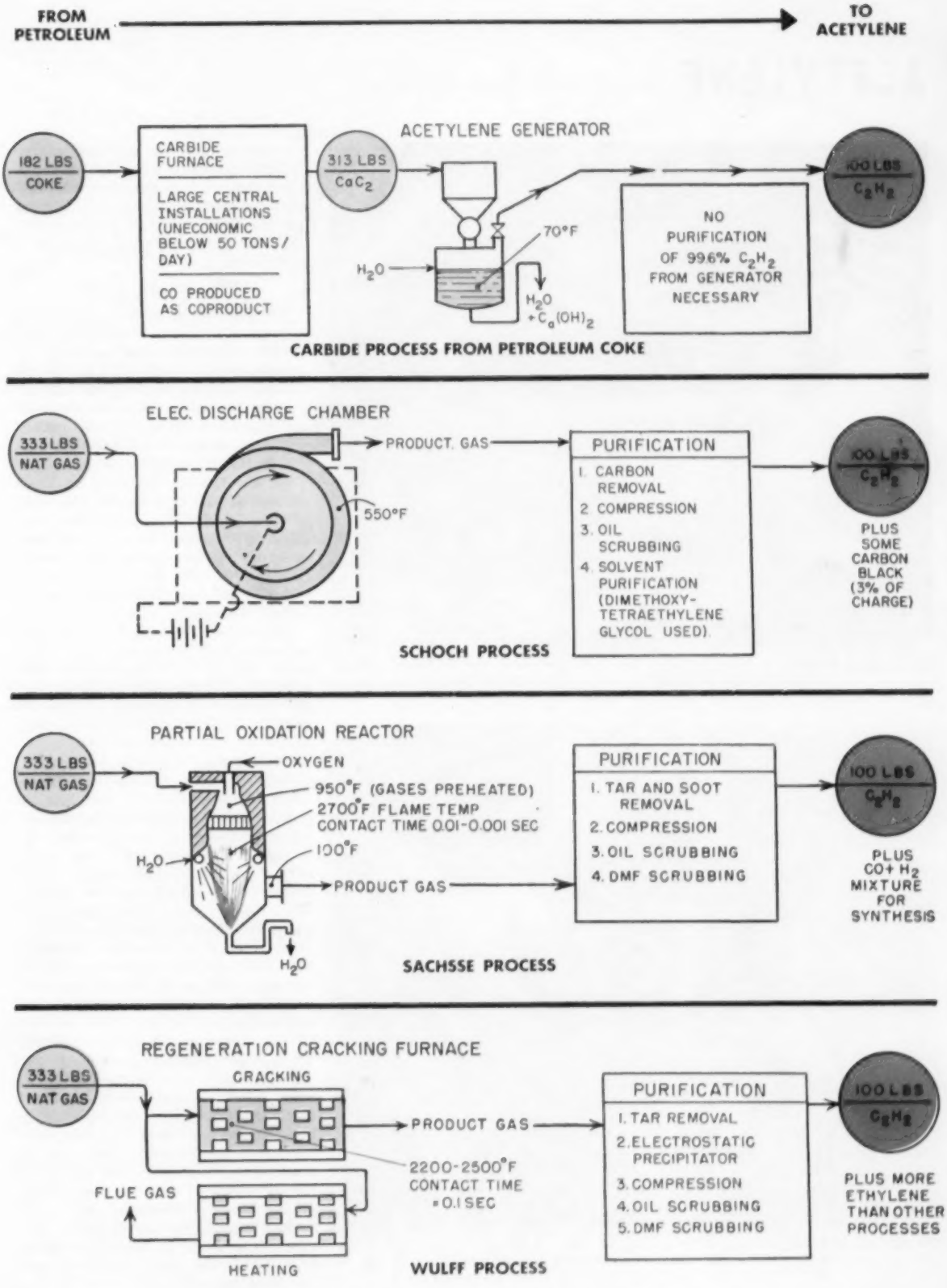
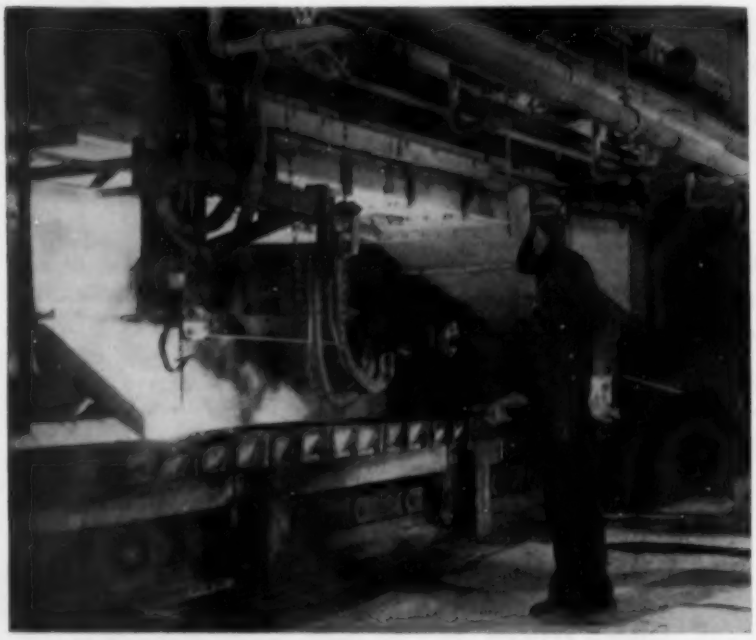
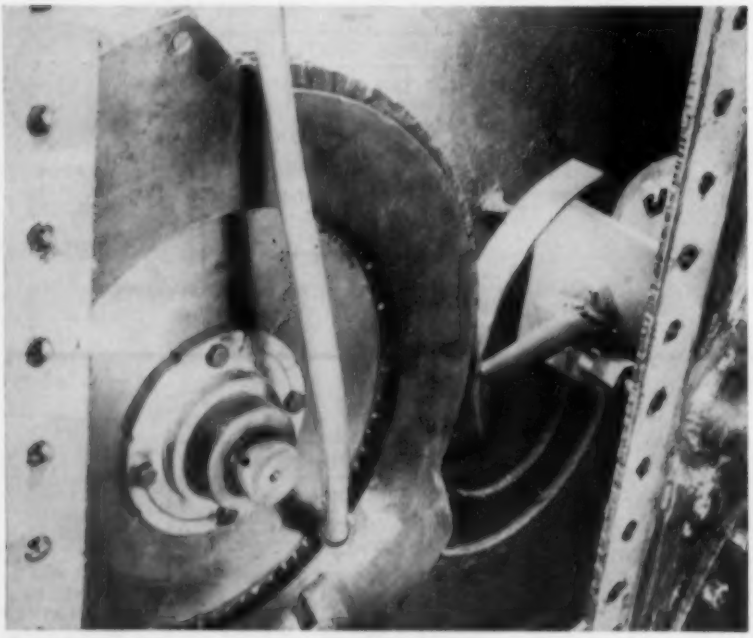


FIG. 3—Four processes for acetylene from petroleum.

ACETYLENE —*How Will It Be Made? (Continued)*



THE CARBIDE PROCESS involves reducing lime with coke in an electric furnace. Here, molten calcium carbide is pouring into ingot molds.



THE SCHOCH PROCESS, an electric arc technique, uses a rotating blower wheel which also serves as one electrode (stationary one at right).

current interest for acetylene manufacture. Although a variety of petroleum hydrocarbons may be used, ranging from methane to heavy oils, natural gas has been used in most cases and the basic equation using methane is as follows:

$$2CH_4 \rightarrow C_2H_2 + 3H_2$$

The problem of producing acetylene is primarily one of reaching an equilibrium favorable to the formation of acetylene (temperatures of 1300-1600° C.) and then of quenching the reaction products rapidly to prevent acetylene decomposition to carbon and hydrogen. Contact times of 0.1 to 0.01 second or less are desirable.

In the above reaction, a large amount of heat must be supplied. This is done by electric energy in an arc (Schoch process), or by indirect heat exchange in a regenerative furnace (Wulff or Koppers-Hasche processes), or by partial combustion of the hydrocarbon feed (Sachsse process).

In the arc (Schoch) process, the maximum reaction temperature is only about 265° C. as contrasted to 1400 to 1600° C. in the other processes. An arc process was operated on a commercial scale in Germany during World War II, but most of the U. S. work on the arc acetylene process has centered at the University of Texas under Dr. E. P. Schoch. The Schoch process uses a rapidly rotating blower wheel which serves as one electrode. A second strip electrode forms a V-shaped gas space around the periphery of the blower wheel, and the blower sends the process gas into this space, where the reaction takes place. Some carbon black is produced as a by-product—about 250 lbs./hr. in a plant producing 20 million lbs. of acetylene per year or about 1.5 lb. per 1000 cu. ft. of feed gas.

In the regenerative furnace (Wulff or Koppers-Hasche processes), a checkerbrick furnace is used as a reactor. The furnace is first heated to cracking temperature by burning a hydrocarbon gas with air. The air supply is then discontinued and the gas is cracked over the hot brick surfaces. Steam admixed with the feed suppresses ethylene formation. For continuous operation, two furnaces are operated as a unit so that one is being heated while the other is carrying out the cracking reaction.

In the partial oxidation (Sachsse) process, the reaction:

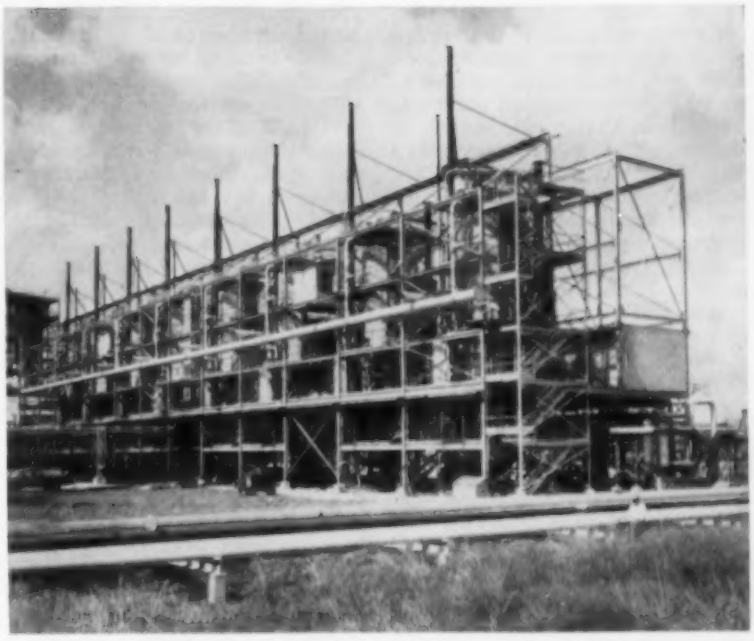
$$CH_4 + \tfrac{1}{2}\ O_2 \rightarrow CO + 2H_2$$

furnishes the heat. This reaction is actually the key to the commercial success of the partial oxidation process since the mixture of $CO + H_2$ is synthesis gas and a valuable feed for other petrochemical operations.

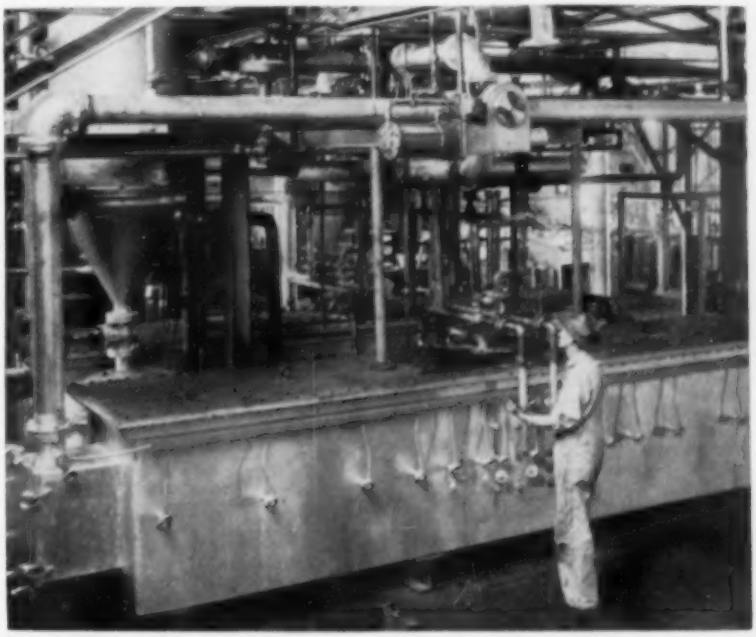
A disadvantage of the partial oxidation process is the need for a tonnage oxygen plant which adds appreciably to investment and operating costs. Careful control of the velocity of the oxygen-hydrocarbon mixture fed to the specially-designed burner is necessary, as is careful control of the quench step where the gases are cooled by a water spray. However, operating characteristics of this process are well understood, according to Forbath and Gaffney,[12A] and fairly extensive operating experience has been obtained in plants which have been operated in Germany and Italy. The charge gases to the burner are mixed in a ratio of 0.65/1.00, oxygen/methane. The oxygen is consumed completely in the flame as is two thirds of the methane; the remaining one third of the methane is cracked to acetylene.

There is a possible variation of the partial oxidation process which uses air rather than oxygen. Although this avoids the investment cost of the tonnage oxygen plant, the large amount of nitrogen in the product gases complicates purification and lessens the value of the by-product gases for synthesis operations.

As a general summary, the partial oxidation process is the only one which has been put into large scale commercial operation in the United States. The regenerative furnace process has been the subject of intensive sales development, but no plants have been built to date. The high power consumption of the arc process (as much per pound of acetylene as for calcium carbide production—about 5 kw. hrs./lb. of acetylene in either case—representing about one cent/lb. C_2H_2) makes this process seem least likely of commercialization since elimination of high power requirements has been the main reason for advocating any of the petroleum-derived acetylene processes over the tried and proven carbide process. Analysis of feed and product from various acetylene processes is shown in Table 2 (p. 1016).



THE SACHSSE PROCESS has been used in this huge partial oxidation acetylene plant of American Cyanamid Co. at Fortier, La.



THE WULFF PROCESS employs a regenerative "checker" furnace, shown here in the pilot operation of Wulff Process Co. in Maywood, Calif.

How Is It Handled? — — ▶

ACETYLENE

1—HOW MUCH IS NEEDED?
2—HOW WILL IT BE USED?
3—HOW WILL IT BE MADE?

4—How Will It Be Handled?

5—WHAT ABOUT FUTURE TRENDS?

THE reaction of calcium carbide with water produces an acetylene gas of 99.6% purity; however, most of the acetylenic products produced by the cracking of petroleum gases contain 8-16% C_2H_2, as described by Sherwood,[13] and as shown in Table 2 (page 1016) taken from Happel and Marsel.[14] Although some work has been devoted to the direct utilization of such dilute gases in chemical processes, it is necessary in general to purify and concentrate the acetylene.

The dilute acetylene gases from the hydrocarbon processes pose several engineering problems. First, there are olefins and higher acetylenes which may be objectionable or hazardous in subsequent processing. Crude arc and pyrolytic acetylene products pose similar problems but acetylene products from partial oxidation processes contain large amounts of carbon dioxide.

As pointed out by Aries and Cziner,[6] the major investment and operating costs in the hydrocarbon acetylene processes are in the separation and purification steps. Separation and purification of the acetylene from the cracked gases may be carried out by selective adsorption, solvent extraction, or a combination of the two. The actual choice of processes depends on the concentration of acetylene in the cracked gas, and the nature of the materials present in the cracked gas, other than acetylene.

Acetylene may be scrubbed from dilute acetylene-containing gases by a variety of solvents. Scrubbing with water under pressure may be employed. A number of organic solvents have been advocated, however.

As described by Sherwood,[13] German war time purification processes for dilute acetylene from hydrocarbons consisted largely of water scrubbing. Diacetylene was removed in a first water scrubber at 160 psi. The scrubbing water from this first tower was then stripped of acetylene and the dissolved diacetylene remaining was discarded, the recovered acetylene being recycled to the first tower. The acetylene from the first scrubber was sent to a second water scrubber where almost all the acetylene and CO_2 were absorbed, leaving an off gas consisting primarily of hydrogen and methane. Upon depressuring the acetylene solution from this second tower to one atmosphere (through an expansion turbine), the balance of the methane and hydrogen is released. The solution is further depressured to 40 mm. Hg. absolute pressure, releasing the acetylene and CO_2. Caustic scrubbing gives a 98-99% acetylene product.

Power costs for this complex purification scheme (two water scrubbers, three strippers, and a caustic scrubber) run about one kwh./lb. of acetylene and the process requires a considerable outlay for equipment.

Modern American practice as described by Happel and Marsel[14] tends away from water scrubbing to a choice between Hypersorption (with a final solvent scrubbing) and a solvent extraction process.

In Hypersorption, dilute product gas from the hydrocarbon acetylene process is compressed to 45 psi. and fed to the Hypersorption tower. In this adsorption-fractionation process, an overhead product contains methane, hydrogen, some CO_2, and inert gases. The bottoms product contains propane, propylene, higher acetylenes and steam introduced to the stripping section of the Hypersorber.

The side cut from the column contains acetylene, containing only some ethane, some ethylene, and some CO_2. This side cut is introduced into a solvent extraction tower for final acetylene purification. Dimethylformamide (DMF) absorbs all the acetylene. The acetylene-rich solvent is heated to release acetylene, the vapors are cooled to condense any entrained DMF, and a 99% pure acetylene product is obtained.

In solvent extraction, an oil wash is necessary as an initial step to remove higher acetylenes and other materials which would be 1) absorbed with the acetylene and contaminate the product gas, and 2) retained in the solvent and polymerize, contaminating the solvent. Thus, the dilute process gas is compressed in three stages to 110 psi., is oil washed to remove C_3 + hydrocarbons and is passed through a bed of carbon to remove any entrained oil. The oil is stripped with the natural gas feed to the process to remove dissolved acetylenes. A DMF tower is then used in the same manner as the tower which follows the Hypersorber in the setup previously described, except that a larger tower is used in the present case since it handles a much larger gas throughput.

Economic estimates by Happel and Marsel[14] indicate about one cent/lb. of acetylene differential in favor of Hypersorption (plus solvent finishing) over a complete solvent extraction process, with total purification costs running 3.7 cents/lb. for Hypersorption vs. 4.7 cents/lb. for extraction.

Work continues on new acetylene separation techniques. One new development is the class of selective adsorbents called "molecular sieves." These materials, developed by Linde Air Products Co., rely on differences in molecular size and polarity and can be used to separate acetylene from propane and higher hydrocarbons.[17] Another new development is the new chemical, dimethyl sulfoxide, recently announced as commercially available from Stepan Chemical Co.[18] Dimethyl sulfoxide is advocated as a solvent for acetylene, absorbing 32% more acetylene than acetone and having three times longer life in acetylene cylinders.

Once available for chemical synthesis, whether prepared by the carbide or hydrocarbon route, acetylene must be handled with care.[16] This is due to the fact that acetylene, unlike most compounds, will decompose into its elements with the evolution of heat, $C_2H_2 \rightarrow C + 2H_2$, liberating 54.9 Kcal./gm. mole (3800 Btu./lb.) of acetylene decomposed. Thus, it is really "happier" when decomposed into its elements than when combined. Also, unlike most organic compounds, it can explode in the absence of any air, as shown by the above equation.

In addition to exploding in the absence of air, acetylene has the disadvantage of having some of the widest explosive limits of any compound. The explosive limits of acetylene in air range from 2.5% to 80%.

Until after World War II, the safe limits on acetylene were considered to be 100° C. and a top pressure of 30 psi. Then, it was learned that German workers had operated safely and successfully at 300 psi. and at temperatures of 250° C.

The statement has been made that the German workers freed the chemistry of acetylene from the limitations imposed by the hazards involved. It has been stated that they raised the vinylation reaction to a status comparable with sulfonation or nitration, as a workable and commonplace industrial process.

Subsequent work in this country by General Aniline and Film Corp. has been carried out at pressures up to

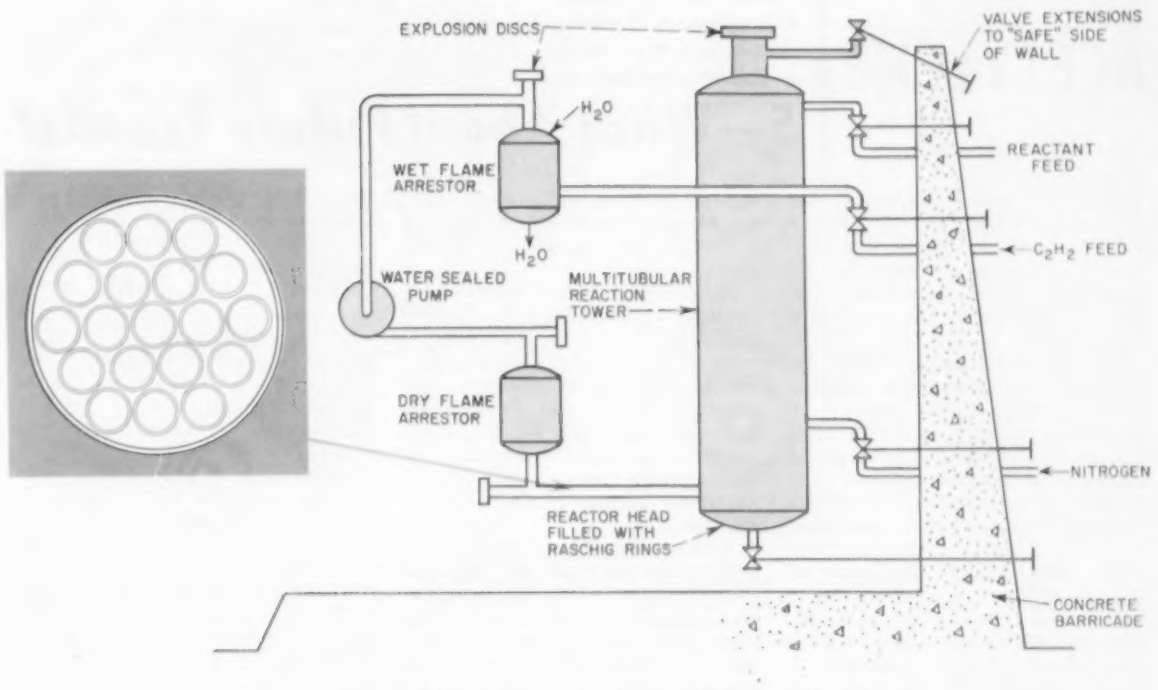


FIG. 4—Safe practices in acetylene manufacture and handling

3000 psi. — tenfold above German war-time practice and one hundredfold above the previous U.S. safe operating limit. Through a combination of Teutonic thoroughness with American inventiveness, several basic design principles were developed to make such operation possible. These are shown graphically in Fig. 4 and are summarized as follows:

1—Elimination of factors which initiate and permit decomposition.

2—Prevention of detonations and confinement of any acetylene decomposition to slow reactions.

3—Design of equipment to withstand moderate decomposition pressures and prevent damage in the event of detonation.

Factors which initiate decomposition include metallic salts of acetylenes and peroxides of higher acetylenes. Acid conditions may be maintained to decompose metallic acetylides where there is a possibility of forming them. Antioxidants may be added in controlled amounts to those sections of a system where higher acetylenes may be present. The use of water-sealed compressors avoids metal-to-metal contact and the possible production of hot spots as focal points for acetylene decomposition.

It has further been determined that moisture content is an important factor in preventing the initiation of acetylene decomposition; assuring saturation of the acetylene with water vapor lessens the explosive hazard where wet acetylene can be tolerated in the process. Although thermal decomposition of acetylene will occur only at temperatures of about 500° C., increased temperature in lower ranges makes initiation of decomposition by other agents more likely.

Low pressures decrease markedly the possibility of igniting acetylene and a threshold pressure exists (at about 10 psi.) below which acetylene cannot be ignited by a platinum fuse wire, for example. Nitrogen, hydrogen, helium and hydrocarbons have been found effective in preventing acetylene decompositions. At 100 psig., 40% natural gas or 60% helium rendered acetylene non-explosive. The effectiveness of hydrocarbon diluents was found to increase with the molecular weight of the hydrocarbon. In German work, up to 60% of nitrogen was circulated with acetylene.

Detonations have been prevented successfully by provision of a multiplicity of closely spaced metal surfaces throughout all parts of the equipment to cool any flame front which is accidentally initiated. Free spaces in reaction equipment were limited to about a quarter of an inch by filling large pipes with small bore tubing and by filling the heads of heat exchangers with Raschig rings. Safety was achieved at some penalty in gas circulation cost and pressure drop.

Pure, dry acetylene is stable below 1.8 atmospheres pressure in 0.2-inch tubes and is stable below 1.4 atm. in 0.8-inch tubes, it has been found. In the German plant for butinediol manufacture, all acetylene pipe lines under pressure were filled with tubes of 0.5-inch maximum diameter. Along the lines of piping configuration, German work with dry acetylene at 18 atm. pressure showed that elbows in pipe lines tended to be focal points for acetylene decomposition. Special packed water wash towers have been installed as decomposition traps where possible.

Equipment is designed to withstand ten times the plant operating pressure, preventing disastrous ruptures in case of mild decompositions. If, in spite of all precautions, a detonation should develop within the equipment, rupture discs are installed at numerous points throughout the plant. Also, acetylene reaction equipment is commonly located in concrete stalls of the type used in the hydrogenation of petroleum. No one is allowed in these stalls during operation and all controls are handled from an operating floor on the outer "safe" side of the stall.

What of Future Trends? — — ▶

ACETYLENE

1—HOW MUCH IS NEEDED?
2—HOW WILL IT BE USED?
3—HOW WILL IT BE MADE?
4—HOW WILL IT BE HANDLED?

5—What About Future Trends?

FUTURE trends for acetylene look very promising. Future prospects for neoprene, vinyl resins, and acrylonitrile are booming. The trend toward the use of acetylene as a raw material for these various products is favorable.

One of the big question marks for the future involves full-scale commercialization of the various Reppe products in this country. Although much has been published about the potentialities of cyclooctatetrene, polyvinylpyrollidone and butinediol,[16] they have been restricted to the pilot plant scale. It is true that Rohm and Haas have built a plant for acrylic acid manufacture at Houston and that General Aniline and Film is extrapolating the pilot plant experience gained at Grasselli, N. J., to full-scale operations at Calvert City, Ky. Broader acceptance of some of the novel end-products of the Reppe reactions will be necessary to broaden this general use of acetylene.

Aside from a wide variety of acetylene derivatives offered by General Aniline and Film, other companies are active in the field as well. Air Reduction Chemical Co. is offering tertiary acetylenic alcohols and glycols, made by the addition of acetylene to ketones. Dimethyl hexyndiol from acetylene and acetone is used as a starting material in the synthesis of the insecticide, allethrin.

Methyl pentynol, a hypnotic, is made from acetylene by this same route. Reilly Tar and Chemical Co. now operates a half-million pound plant manufacturing acetylenic alcohols; they have been in commercial production of these materials for two years. Reilly also is synthesizing pyridine and alkyl pyridines from acetylene and put this process on a commercial scale in 1953.

Others are working diligently on new products from acetylene. American Cyanamid has a new diarylethane process, starting with acetylene and toluene. These diarylethanes can be cracked over clay catalysts to give methylstyrene as an important raw material for plastics.

Although all of this points to growing acetylene uses, both the over-all growth of acetylene usage and the preferential growth of either the carbide or hydrocarbon routes depend on the availability of low cost acetylene. It has been very interesting to watch the conflict between the carbide producers and the licensors of hydrocarbon acetylene processes as shown by

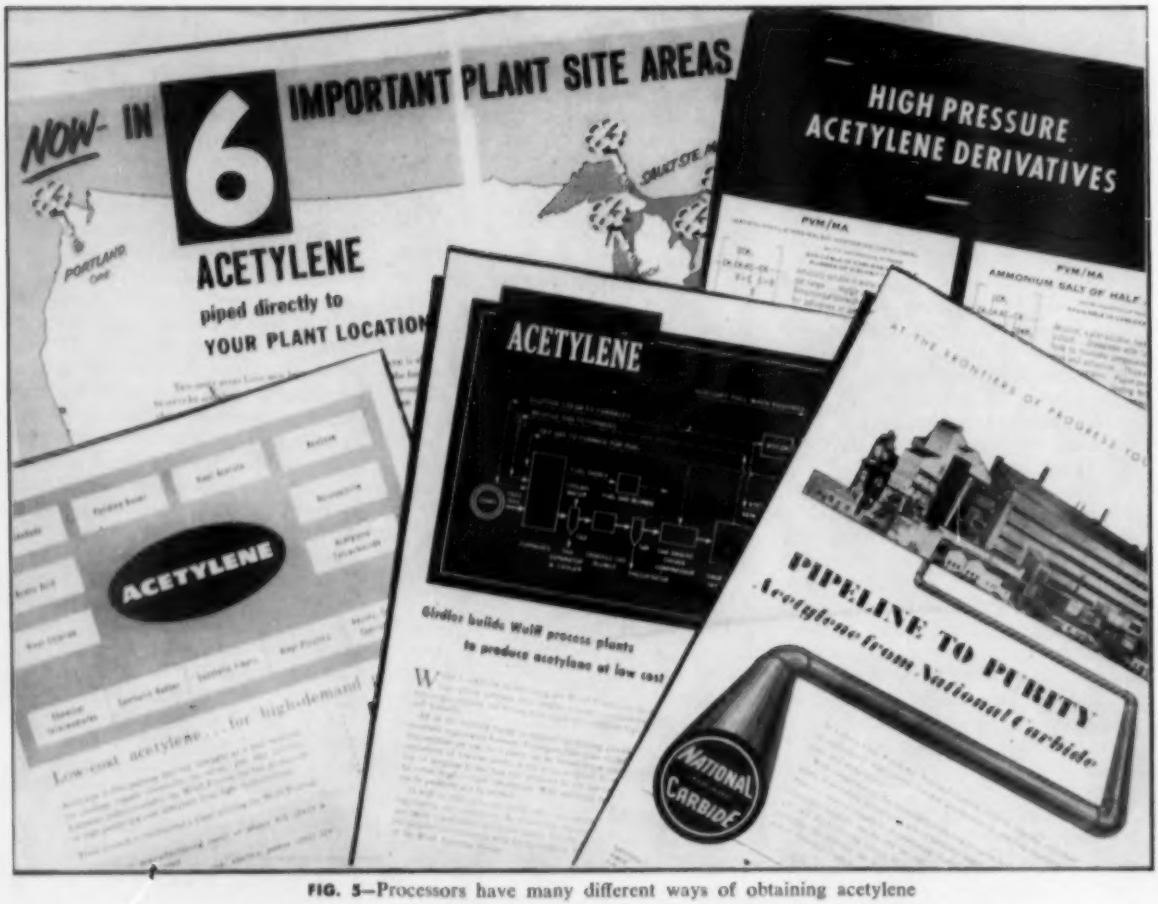


FIG. 5—Processors have many different ways of obtaining acetylene

advertisements in the various chemical and petroleum trade journals, as illustrated on these pages.

The carbide producers, on one hand, have been plugging the concept of "pipe line acetylene" and "acetylene—sold by meter"—encouraging prospective consumers of acetylene to locate adjacent to strategically located carbide acetylene plants, locations usually offering other basic raw materials in the vicinity, and close to markets as well.

Licensors of acetylene processes (and particularly of the Wulff process) have been singing the virtues of "low cost acetylene—for high demand products." The "box score" for post-war installations is shown in Table 3.

Investment costs are generally considered to be lower per 1000 cu. ft. for acetylene from carbide. A figure of $6.00 for carbide acetylene has been quoted[3] as compared to $8.95 for Wulff process acetylene. However, Happel and Marsel[14] quote investment figures for 20 million lb./yr. plants of $2.50 for the Schoch process, $7.85 for the Sachsse process (largely in the oxygen plant) and $1.80 for the Wulff process.

The cost of carbide acetylene has been estimated at 11 cents/lb.,[3] based on calcium carbide at $60.00/ton. It is further estimated that improved furnace design and lower power costs may give 9½ cent acetylene from carbide. The break-even point now may be as low as 7½ cents.

In contrast, the cost of acetylene from hydrocarbons is estimated to be somewhat lower. Sherwood[13] estimated costs from 4.2 to 4.9 cents/lb. for dilute acetylene from hydrocarbons by the three processes, with costs of 98% acetylene (comparable in purity to that obtained directly from carbide) running about 8 cents (November, 1948, prices). A much greater spread between estimated costs for the various acetylene-from-hydrocarbon processes has been presented by Happel and Marsel[14] who quote costs, in cents/lb. of acetylene, as follows:

Process	Schoch	Sachsse	Wulff
Exclusive of purification	6.06	5.90	2.26
For purification	3.69	3.64	3.58
For pure acetylene	9.75	9.54	5.84

These figures, paradoxically, show the lowest cost for the Wulff process, as yet unapplied on a large scale, and almost the highest cost for the Sachsse oxidation process, the only process used widely in this country.

All three hydrocarbon acetylene processes seem to be competitive with the older carbide process, depending on local availability of raw materials and on local utility costs. The background of successful operation plus the desirable synthesis gas by-product gives the Sachsse process most installations to date, but attractive paper economics plus intensive competitive salesmanship may push the Wulff or Koppers-Hasche processes ahead rapidly.

Both carbide acetylene and hydrocarbon acetylene will continue to grow, hydrocarbon acetylene at a faster rate. Carbide acetylene will remain dominant for filling acetylene cylinders at scattered points and will expand at new carbide plants delivering pipe line acetylene to a cluster of surrounding chemical plants. Arc process hydrocarbon acetylene will be made where power costs are low and where limited quantities of acetylene are needed. The big plant expansion race will be between oxidation processes such as the Sachsse process, and thermal processes such as the Wulff process.

What will the future hold? New markets for new acetylene chemicals? More new acetylene consumers clustered around huge, efficient carbide plants? More and better utilization of acetylene from hydrocarbons? Probably all of these—so keep your eye on acetylene, the chemical with a big future.

Table 3—The Acetylene Box Score

(U.S. expansion since World War II)

Producer	Acetylene Process	Product	Plant Location	Scale
DuPont	Carbide	Neoprene	Louisville, Ky.	Large
DuPont	Carbide	Neoprene	Montague, Mich.	Large
General Aniline	Carbide	Reppe products	Calvert City, Ky.	Large
General Aniline	Carbide	Reppe products	Grasselli, N.J.	Pilot
Air Reduction	Carbide	Vinyl acetate	Calvert City, Ky.	Large
Air Reduction	Carbide	Acetylenic alcohols	Boundbrook, N.J.	Pilot
Reilly Tar & Chem.	Carbide	Acetylenic alcohols	Indianapolis,Ind.	Large
Reilly Tar & Chem.	Carbide	Pyridines	Indianapolis,Ind.	Large
Rohm & Haas	Carbide	Acrylic esters	Houston, Texas	Large
Goodyear	Carbide	Vinyl chloride	Niagara Falls, N.Y.	Large
U. S. Rubber	Carbide	Vinyl chloride	Painesville, Ohio	Large
B. F. Goodrich	Carbide	Vinyl chloride	Louisville, Ky.	Large
General Tire	Carbide	Vinyl chloride	Ashtabula, Ohio	Large
B. F. Goodrich	Carbide	Vinyl chloride	Niagara Falls, N.Y.	Large
B. F. Goodrich	Carbide	Vinyl chloride	Calvert City, Ky.	Large
B. F. Goodrich	Carbide	Acrylonitrile	Calvert City, Ky.	Large
Dupont	Carbide	Trichloroethylene	Wyandotte, Mich.	Large
Hooker-Detrex	Carbide	Trichloroethylene	Ashtabula, Ohio	Large
Monsanto	Hydrocarbon oxidation	Acrylonitrile	Texas City, Texas	Large
Carbide & Carbon	Hydrocarbon oxidation	Vinyl esters	Texas City, Texas	Large
Amer. Cyanamid	Hydrocarbon oxidation	Acrylonitrile	New Orleans, La.	Large
Wulff Process Co.	Regen. furnace	Cylinder acetylene	Maywood, Calif.	Large

References

(1) Guthrie, V. B., PETROLEUM PROCESSING, Vol. 7, No. 7, pp. 997-981 (July, 1952).

(2) Ruebensaal, C. F., *Chem. Engrg.*, Vol. 59, No. 11, pp. 159-162 (Nov., 1952).

(3) Anon., *Chem. Eng. News*, Vol. 28, No. 49, pp. 4244-4247 (Dec. 4, 1950).

(4) "A Report for Oklahoma Planning and Resources Board," Blaw-Knox Co., Tulsa, Okla. (Nov. 15, 1954).

(5) Anon., *Chem. Eng. News*, Vol. 32, No. 31, pp. 3032-3034 (Aug. 2, 1954).

(6) Aries, R. S., and Cziner, R. M., *Petroleum Refiner*, Vol. 31, No. 5, pp. 127-132 (May, 1952).

(7) Anon., *Petroleum Refiner*, Vol. 32, No. 11, p. 134 (Nov., 1953).

(8) Anon., *Chem. & Met. Eng.*, Vol. 51, No. 1, pp. 130-133 (Jan., 1944).

(9) Groggins, P. H., "Unit Processes in Organic Synthesis," 4th Edition, McGraw-Hill Book Co., New York, N. Y. (1952).

(10) Sherwood, Peter W., PETROLEUM PROCESSING, Vol. 9, No. 3, pp. 384-389 (March, 1954).

(11) Shreve, R. N., "Selected Process Industries," McGraw-Hill Book Co., New York, N. Y. (1950).

(12) Anon., *Chem. and Engr. News*, Vol. 31, No. 6, pp. 560-563 (Feb. 9, 1953).

(12A) Forbath, T. P., and Gaffney, B. J., *Petroleum Refiner*, Vol. 33, No. 12, pp. 160-165 (Dec., 1954).

(13) Sherwood, P. W., *Petroleum Refiner*, Vol. 27, pp. 573-577 (1948).

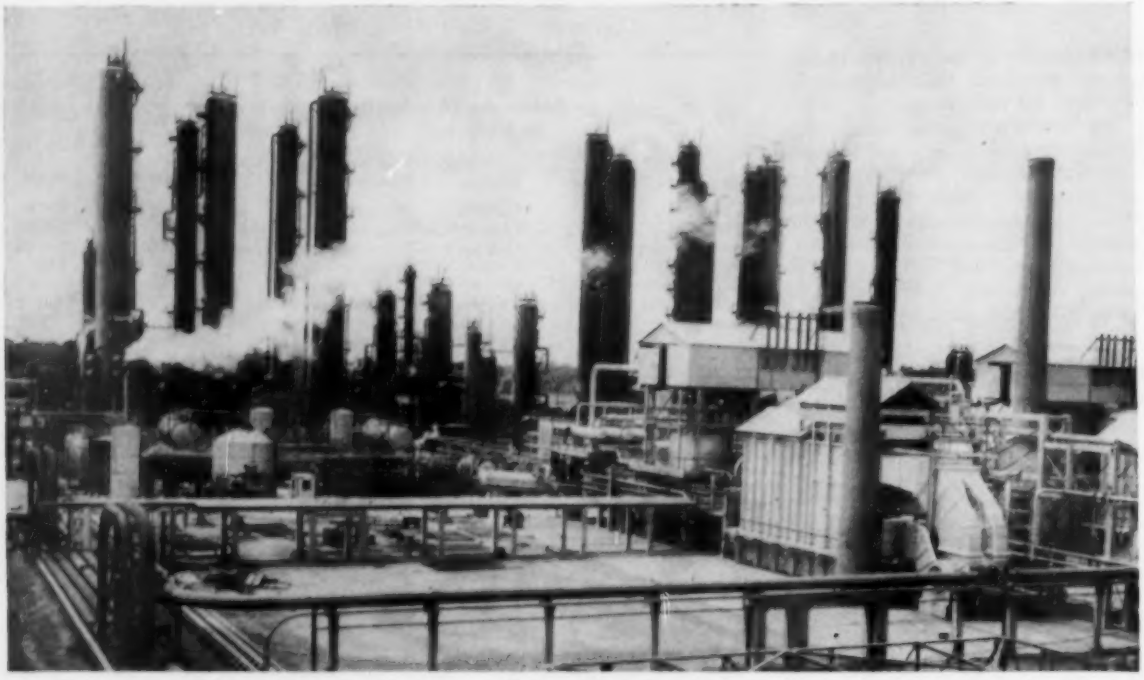
(14) Happel, John, and Marsel, C., *Chemical Industries Week* (April 28, 1951).

(15) Lynn, R. E., Jr., and Kobe, K. A., *Ind. Engrg. Chem.*, Vol. 46, pp. 633-643 (1954).

(16) Sittig, Marshall, PETROLEUM PROCESSING, Vol. 4, No. 1, pp. 23-26 (Jan., 1949).

(17) Anon., PETROLEUM PROCESSING, Vol. 10, No. 1, pp. 79-82 (Jan., 1955).

(18) Anon., PETROLEUM PROCESSING, Vol. 10, No. 2, pp. 151-152 (Feb., 1955).



BUTADIENE NOW, PETROCHEMICALS NEXT? former government plant at Houston, now owned by new firm, Petro-Tex Chemical Corp., who figure . . .

It's an Easy Shift . . .

From Butadiene to Petrochemicals

ACQUISITION of one former government-owned butadiene plant has not only been signaling the start of a petrochemical venture for its new owners, but is opening the door to probable further diversification in the field.

Food Machinery & Chemical Corp., successful bidder for the 90,000-short tons/year plant formerly operated by Sinclair Rubber, Inc., at Houston, announced May 20 that jointly with Tennessee Gas Transmission Co. it had formed a new company—Petro-Tex Chemical Corp.—to own and operate the $24,197,000 plant.

Plans of the new owners may indicate a pattern to develop with other butadiene plants now in the hands of private business.* The Houston plant is scheduled for an increase in capacity of at least 50% within five years. Part of the increase already is being designed.

Food Machinery, already in the chemical field, has been wanting to get its foot into petrochemicals for some

*"The Pattern Changes for Petroleum's Role in Synthetic Rubber," PETROLEUM PROCESSING, March, 1955, pp. 375-381.

By D. P. THORNTON, Jr.
Southwestern Editor

time. So when the butadiene plants were put up for sale, it bid and simultaneously negotiated a contract with Tennessee Gas Transmission to become equal partners if the bid was successful. TGT could furnish not only its share of capital but also basic raw materials should the need materialize.

FMC's plans were still more ambitious, however, because with TGT's supplies of light hydrocarbons (it owns one natural gasoline plant and has working interests in others) it could go the whole gamut of possibilities derivable from methane through the C_{10}'s. TGT likewise has been desirous of getting into petrochemicals.

The butadiene plant does not at present draw all its butylenes from Sinclair's Houston refinery. The balance comes from several other refineries in the nearby area. Sinclair will continue as a major supplier under long-term contract and the inference is that the others likely will continue.

If there is a deficiency, TGT can make up the difference in the form of butane and the plant will install additional dehydrogenating facilities to convert it to butylenes, providing the butane cannot be purchased more advantageously from others.

Butadiene will be marketed at the same price as prevailed under government operation for the foreseeable future. This despite the fact that, as a privately-owned enterprise, the plant now will be subject to income and property taxes.

Present expansion plans are synchronized with those already announced for the adjacent Goodyear Synthetic Rubber Corp. plant. Petro-Tex has not announced what the initial increase for its plant will be. It makes no bones about its intention that synthetic rubber will not be its only outlet for butadiene. Company has announced, however, that engineering has already commenced for an initial expansion and that start of construction is anticipated for late 1955; unofficially, about 10% or roughly 10,000 short tons annually looks like a good guesstimate. Bottleneck removal

may account for a part of this.

Also announced are plans to construct a research center in the New York area, site undisclosed, which will cost approximately $1,500,000. Work there will concentrate about the development of other butadiene petrochemicals than indicated applications in such materials as nylon. Process research also will be initiated in Houston.

The annual research expenditure will be on the order of $1,000,000 and will come from a "substantial portion" of the profits of the new corporation. Company also says this is just the first step in basic research into petrochemical possibilities of the raw materials which can come from Petro-Tex's present operations and those which TGT can supply.

At present, it is not clear whether Petro-Tex will make intermediates or finished products from butadiene petrochemicals its research may develop, or merely supply the butadiene.

Down the road TGT is looking into the possibilities of constructing a stripping plant in the Channel area astride a loop or by-pass of a gas line and can, if necessary, either gather or cause to be gathered the required gas from uncommitted sources.

This stripping plant could not only provide butane for dehydrogenation but likewise pure fractions of other hydrocarbons. Also, plants now supplying Petro-Tex with butylenes from streams containing other C_4 homologues which are returned to them might prefer to sell the whole stream. Such an arrangement probably would be the first step preceding a stripping plant.

The Petro-Tex plant, is located on a 275-acre site southeast of Houston on the Houston-Pasadena highway. It is the second largest butadiene plant, exceeded only by the 95,000 ton plant at Pt. Neches, Texas, purchased by Goodrich, U.S. Rubber, Gulf Oil and The Texas Co.

Present operations area involves only 88 acres with the unimproved sections lying south and west of it. Facilities include units for feed preparation of raw stocks received by pipe line and tank car to segregate n-butylene, catalytic dehydrogenation of this to butadiene, furfural extractive distillation to recover pure butadiene and segregate butylene-2 for recycling, and propane recovery facilities. By-products include isobutane, n-butane and isobutylene polymer.

Other facilities include a 35,000 Kw turbogenerator, which also supplies power to the adjacent synthetic rubber plant and sells the excess to Houston Lighting & Power Co., steam generators for both plants and three wells with a total pumping capacity of 3700 gpm. The plant has 60 buildings, 30 of which are of masonry construction, and 54 major and 11 smaller storage and surge tanks. There are approximately 450 employees.

Do You Know These Words?

By B. H. WEIL
Manager, Information Services
Ethyl Corp. Res. & Engrg. Dept.
Detroit, Mich.

A regular department intended to help administrators and operating men alike keep abreast of technical names and processes in the petrochemical field.

Hydrochloric Acid

Hydrochloric acid, which has the simple formula HCl—an atom of hydrogen and an atom of chlorine—is a chemical which is at least partially familiar to chemistry student and petroleum man alike. What is not so well known about this chemical, however, is that it is now produced in very large quantities (over 50% of total production) as a byproduct from petrochemical and related reactions—the chlorination of hydrocarbons such as natural gas, benzene, olefins, etc. Pronounced "**hy**-dro-**klo**-rick **ass**-id," it is a solution of hydrogen chloride gas in water; in industry, the name "hydrochloric acid" is sometimes used interchangeably with "hydrogen chloride." The commercial acid is also known as "muriatic acid," and is a clear, yellowish, fuming, poisonous liquid.

Hydrochloric acid finds extensive use in the manufacture of chemicals, including dyes, intermediates, ethyl chloride for TEL, vinyl and vinylidene chlorides for plastics, and others. In the petroleum industry, it is used in the acidization of oil wells, the isomerization of n-butane to isobutane, etc. Another extensive use is in the field of metals — pickling, etching, descaling, cleaning, leaching of ores. It also finds use in the conversion of corn into corn sugar and in the production of monosodium glutamate.

Classic method of manufacture has been the reaction of common salt and sulfuric acid, the hydrogen chloride evolved as a gas then being absorbed in water. This method is rapidly fading from the scene and is being replaced by the burning of hydrogen in an atmosphere of chlorine and, as mentioned, by the use of vast quantities of byproduct hydrogen chloride from the chlorination of hydrocarbons.

Total production currently exceeds three quarters of a million tons a year, and is at present somewhat in excess of demand. When this excess will be eliminated will depend on the construction of additional HCl-using plants and the success of inroads on markets for competing sulfuric acid.

Acrolein

Acrolein, pronounced "ah-**crow**-lee-ihn," is a colorless to yellowish liquid which has the irritating, choking odor that gave it its Latin-based name ("sharp to smell"). It is highly flammable, toxic, lighter than water, and soluble in water, alcohol, and ether. It has the formula CH_2:CH•CHO, which means that as an olefinic aldehyde it possesses two points of high reactivity: the olefinic double bond (C:C) and the carbonyl (C:O) part of the aldehyde (•CHO) radical.

Although over 800 acrolein derivatives have been reported in the literature, and the product has been commercially available in limited quantities since 1946, price and handling hazards have until recently combined to limit progress. Now, however, two major petrochemical companies are producing or planning to produce acrolein in large quantities at a drastically reduced price. Both will offer it for sale as such, although it is reported that some (smaller) users will prefer to bypass the handling difficulties by purchasing acrolein derivatives. End products based on acrolein will include synthetic glycerine (by a new process), methionine, drugs, textile chemicals, and plastics.

In the past, acrolein has been produced by the oxidation of allyl alcohol (a propylene derivative, currently used in the synthesis of glycerine), by the dehydration of glycerine itself, or even by the destructive distillation of fats. At least one of the major producers, however, is said to plan to produce it by the catalytic oxidation of propylene. As mentioned frequently in this series, propylene is a constitutent of refinery cracked gases, and can be prepared deliberately by the cracking of propane.

As *Chemical Week* recently put it, "commercial chemical development has racked up an impressive achievement in harnessing a rambunctious chemical—acrolein—for industrial application."

Sinclair-BAKER RD 150

PLATINUM CATALYST

guaranteed high yields and long life at high octane levels.

REGENERATES IN SITU . . !

The initial efficiency plus regenerative features of Baker's RD150 are unique and of major importance to the petroleum industry. RD150 assures greater yields at high octane levels . . . exceptionally long periods of operation . . . regeneration in situ! RD150 is a joint development of Baker & Co., Inc. and Sinclair Research Laboratories. It is presently being used by such companies as Sinclair, Socony and Pure Oil.

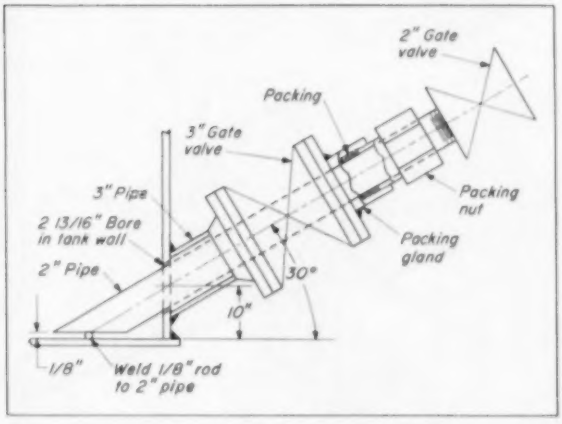
The very extensive facilities for manufacture and refining in modern Baker plants, provide full assurance of prompt deliveries and service.

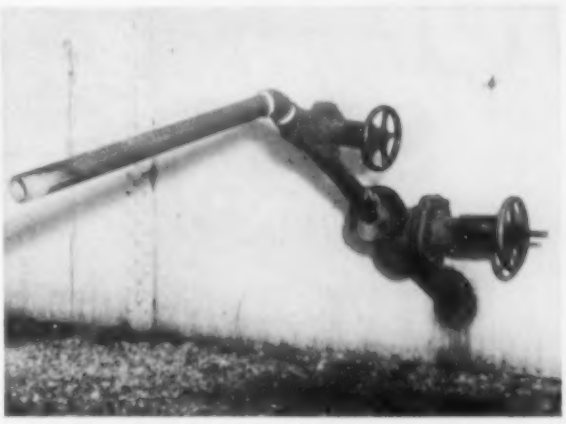
Upon request, a Baker representative will be glad to give you detailed information.

BAKER & COMPANY, INC. CATALYSTS

113 ASTOR STREET
NEWARK, N. J.

THE HUB OF PLATINUM METALS RESEARCH





Adjustable water drawoff can be installed on "live" gasoline storage tanks

Tank Water Drawoff Is Adjustable

SOCONY-VACUUM Oil Co's refinery at East Chicago, Ind., has installed adjustable level water drawoff lines on some of their "live" gasoline storage tanks which do not have sumps.

Several advantages result from adjustable level drawoffs. They are useful when there is a small leak near the tank bottom. Water in the tank is controlled to a higher level, allowing the water, not the product, to leak from the tank until repairs are possible. Also, it is possible to obtain maximum tank drainage prior to interior repairs or inspection.

An installed adjustable drawoff is shown in the photograph above. The drawoff consists of a slanted nozzle which can slip into or out of a packing gland attached to a "sleeve" welded to the tank wall at a 60 degree angle.

The end of the drawoff next to the tank bottom has an angled cut so as to be parallel to the tank bottom—see the drawing above. Along this angled cut, a single piece of ¼-in. rod is welded lengthwise to prevent the drawoff from being closed when pushed flush with the tank bottom.

The entire 2-in. nozzle can be removed through the packing gland, while simultaneously closing the 3-in. sleeve valve to prevent gasoline spillage.

Installation of the drawoff on a tank filled with gasoline required the development of several special techniques.

First installation step for the adjustable drawoff is to fabricate a sleeve out of 3-in. pipe. One sleeve end—to be welded to the outside of the gasoline tank—has a 30 degree cut. The other end of the sleeve has a welded flange.

The sleeve is welded—with a leak-tight bead—to the tank exterior at the desired location. Into the sleeve is inserted a "plug" of 3-in. solid bar stock—one end having a 30 degree cut, the other end being perpendicular to the sleeve walls. This plug is necessary to furnish a square surface for a drill to begin its bite.

After inserting the plug, a guide bushing is inserted into the sleeve to center the lower end of a drill bit. The 3-in. gate valve—full open—and the packing gland are attached to the sleeve. Instead of using packing and a nut while drilling the hole, a guide bushing is placed onto the gland to center the upper end of the drill bit.

An air-motor driven drill bit is inserted through the guide bushings and the open 3-in. gate valve. A hole is drilled through the bar stock plug and the tank wall. As soon as the tank wall is penetrated, the drill bit is removed and the 3-in. gate valve closed immediately to minimize spillage from the tank.

The upper drill guide is replaced by packing and a packing nut, into which is inserted the prepared 2-in. drawoff nozzle—complete with a closed valve on the outer end. The gland nut is tightened, the 3-in. sleeve valve is opened, and the drawoff nozzle pushed into place.

Now the adjustable level drawoff is ready to remove water from the tank by gravity or by the use of a small suction pump that is connected to the outer end of the 2-in nozzle.

Cash in on Your Ideas!!

Do you know of some "off-the-beaten-track" improvisation around your plant? Why not write it up as a plant practice item? PETROLEUM PROCESSING will pay for those acceptable for publication. Take a look today, then send us the idea along with a photo or drawing. Send your ideas to:

Plant Practices Editor
PETROLEUM PROCESSING
330 West 42nd Street
New York 36, N. Y.

More Plant Practice Tips on page 1028 ► ► ►

Aromatics Recovery

TENNESSEE'S

SO_2

LIQUID SULFUR DIOXIDE

Efficient—Economical

SOLVENT

Liquid Sulfur Dioxide has proven itself as the efficient and economical solvent for the recovery of aromatics. It is completely miscible with aromatic hydrocarbons over a wide temperature range, while the solubility of napthene and paraffin hydrocarbons is limited and decreases with decreasing temperature. Recovery of a higher percentage is obtained.

Tennessee's high quality Liquid Sulfur Dioxide can be effectively and economically applied to your operation. We would like the privilege of discussing this with you.

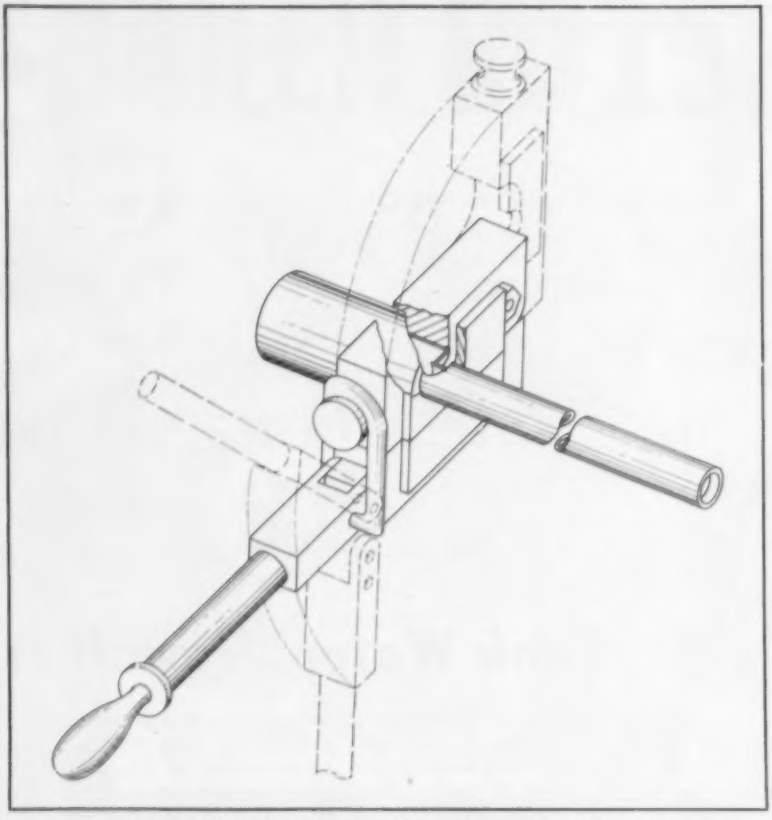
SULFUR-DIOXIDE HIGHEST QUALITY SO_2

Available in: Cylinders, Ton Drums, Tank Trucks and Tank Cars

TC

TENNESSEE CORPORATION

617-629 Grant Building, Atlanta, Ga.

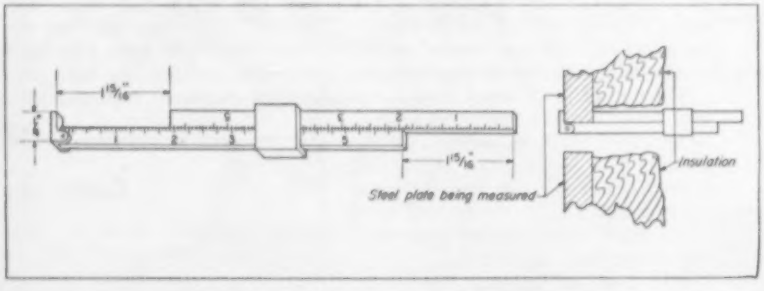


CLAMP HOLDS FINNED-TUBES while attaching enlarged stub ends

Jig Aids Finned-Tube Assembly

Where it is necessary to assemble finned tubes into fixed end tube sheets, one tube sheet is usually drilled to receive the plain tube end while the other is enlarged to clear the finned section. This necessitates the attachment of an enlarged stub end to the plain tube for making the closure.

Fabricating the stub end at Sun Oil Co.'s Marcus Hook refinery is facilitated by the clamping jig shown in the above drawing. The jig performs two operations preparatory to rolling, (1) aligns the stub end to the main tube, and (2) holds the main tube against rotation while rolling.

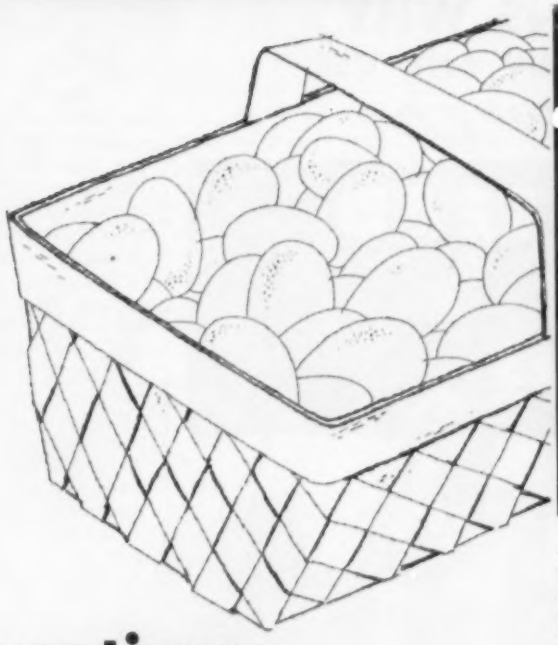


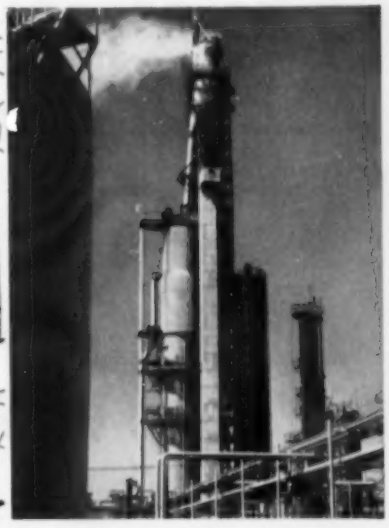
Rule Gage Speeds Vessel Inspection

At The Pure Oil Co. refinery, Lemont, Ill., both insulated and uninsulated process vessels are inspected regularly by drilling a 21/64-in. inspection hole through the vessel and measuring the thickness of the wall underneath any insulation present. After inspection, the hole is tapped and plugged with a ⅛-in. steel pipe plug, and the insulation in that area is replaced.

The difficulty in this procedure

Capsule Case History:

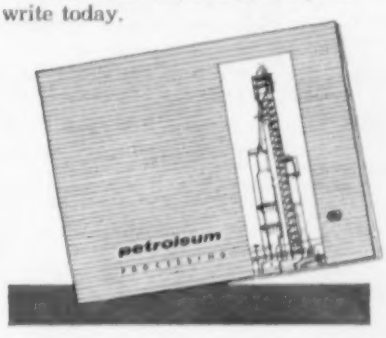




A Packaged Project
this modern moving-bed Houdriflow cat-cracker was designed and built by Kaiser Engineers for a major southwest petroleum refinery. This unit operated 13 months without a shutdown after first going on stream.

Responsibility for All Phases
of design, engineering, procurement and construction is another feature of the services available to your firm from the KE team of specialists.

The KE petroleum brochure (No. 103) —which features this refinery addition will be mailed to you upon request—write today.



Sometimes it pays...

Kaiser Engineers, a close-knit team of specialists, is staffed to handle every phase of your project. Their work in widely divergent fields of design and construction offers plenty of proof that it pays to put all your project eggs in this one basket.

kaiser | engineers ...for low operating costs

DIVISION OF | HENRY J. KAISER COMPANY

ENGINEERS K CONTRACTORS

• HOME OFFICE: KAISER BUILDING, OAKLAND 12, CALIFORNIA (CABLE: KAISENGS) NEW YORK, PITTSBURGH, WASHINGTON, D.C.
• HENRY J. KAISER CONSTRUCTION CO. • HENRY J. KAISER COMPANY (Canada) LTD., MONTREAL • KAISER ENGINEERS INTERNATIONAL, INC.

for measuring the thickness of a vessel wall which is covered with several inches of insulation is that the insulation interferes with the use of standard measuring equipment.

Rather than remove large areas of this insulation to allow measuring the thickness of the vessel wall underneath the insulation, The Pure Oil Co. inspection staff developed a simple machinist hook-rule-gage.

The gage is shop made, and simply consists of two standard machinist rules—approximately ⅛-in. wide and 6-in. long—connected together with a sliding sleeve. One rule—the one to be inserted into the inspection hole for measurements—has a hook bradded perpendicular to the rule and flush with the end of the rule. The other rule—held adjacent to the first rule so that the measuring scales touch—merely slides back and forth through the sleeve (see left side of drawing (on page 1028).

In use for measuring vessel wall thicknesses, the hook-rule-gage is "hooked" through a 21/64-in. inspection hole which has been drilled through both the insulation and the metal vessel wall—shown at the right side of the drawing—and pulled so that the hook is flush with the inside surface of the steel plate to be measured. The other rule is then slid through the sleeve until its end is flush with the outside of the metal portion of the vessel wall.

To read wall thicknesses in this manner, the rule can be left in place and the wall measurement obtained from the outer end of the rule, or the rule can be disengaged from the hole and read nearest the hook end of the rule.

No. 5* of . . .

12 REASONS WHY
YOU SHOULD BUY AND USE
LOW-PRICED
HOMESTEAD
Lubricated
PLUG VALVES
Pat. Pending

Homestead's exclusive completely controlled lubricant system positively prevents sticking by its instant, piston-like movement of the plug downward at the start of each lubrication. Spring and line pressure return it to stem-sealed position.

This is only **one reason why you should buy and use low-priced** HOMESTEAD LUBRICATED PLUG VALVES.

HERE ARE ALL TWELVE

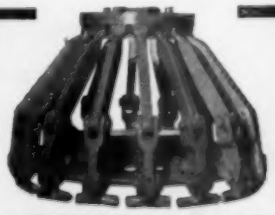
1. Extra long valve life assured by very close tolerance between seating surfaces.
2. Straight line fluid flow—streamlined ports—minimum resistance to flow—minimum pressure drop.
3. Triple head seal—two lubricant rings and reinforced Teflon stem seal prevent leakage.
4. Easy turning—plug floated on Teflon washer and reinforced Teflon ring.
5. Leak-proof double ball and lubricant sealed check valve. No springs. No maintenance.
6. Full-threaded screw prevents dirt being forced into lubricant system.
7. Quarter-turn fully opens or closes.
8. Reinforced Teflon stem seal—no cold flow—continuous, positive seal.
9. Seating surfaces protected in both open and closed positions.
10. High pressure lubricant system provides full lubricant seal around ports.
11. Self-freeing plug prevents sticking.
12. Two lubricants handle most services.

FOR CATALOG AND COMPLETE DETAILS MAIL COUPON TODAY

Without obligation, send Reference Book 39—Section 5 on HOMESTEAD LUBRICATED PLUG VALVES.

NAME _____ TITLE _____
COMPANY _____
ADDRESS _____
CITY _____ STATE _____

HOMESTEAD VALVE MANUFACTURING COMPANY
Serving Since 1892
P. O. BOX 43 CORAOPOLIS, PA.



BARRETT automatic
Filling and Crimping Equipment
for handling greases and other viscous fluids.
- No operator required.
- 100% air operated.

Fills, seals, stamps and counts lug cover pails. Output of 15 pails per minute. Write for details on installation to meet your requirements.

BARRETT
Manufacturing Co.
P. O. Box 8096, Houston 4, Texas

That Terrific Traffic!

An avalanche of steel, glass and rubber! But one hand can stop it. And a common source creates it.

It's the refractory brick which line the furnaces of industry.

Everything you buy or use owes its place in your home to refractories, which must meet demands of almost infinite variety and severity.

To make them, General Refractories employs the research of the world's largest and most modern refractories laboratory . . . brings materials from half way round the globe. And provides them to industry swiftly . . . dependably . . . economically from a multitude of strategically located plants and warehouses.

GENERAL REFRACTORIES CO. PHILADELPHIA 2

GENERAL REFRACTORIES

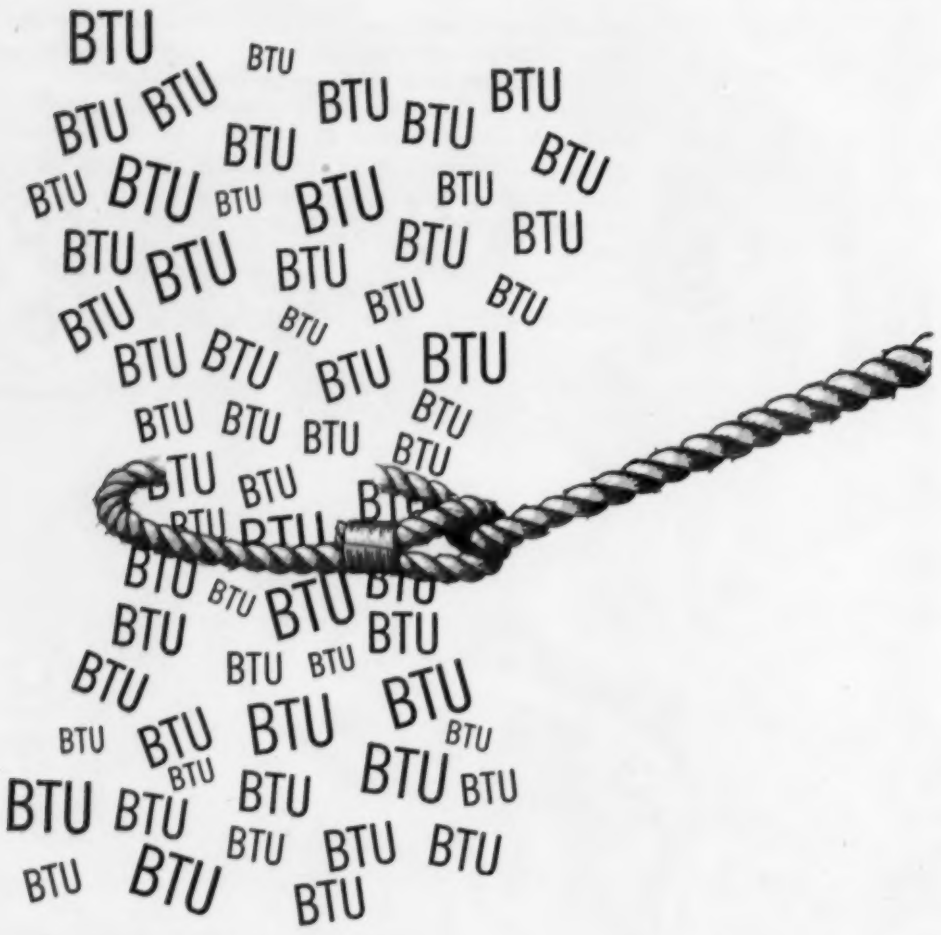
A COMPLETE REFRACTORIES SERVICE

FOR THE PETROLEUM INDUSTRY . . .

LITECAST-50—A hydraulic setting light weight castable having a density of approximately 50 lbs. per cu. ft. Available in regular mix and pneumatic gun mix.

HIGH-STRENGTH BRIK-CAST—A hydraulic setting clay base castable having exceptionally high strength. Available in regular, pneumatic gun mix and trowel mix.

GREFCO CASTABLES are manufactured at 4 strategically located plants in Pennsylvania, Missouri, Texas, and California.



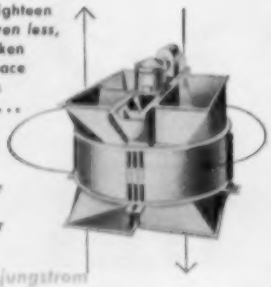
cut fuel costs

you can save one barrel in every five with the Ljungstrom® Air Preheater

HOW FAST IS "WRITE OFF"?

In fuel savings alone, most refiners write off the cost of the Ljungstrom installation in twelve to eighteen months. This time is cut to *nine months and even less*, when the other Ljungstrom advantages are taken into account – permits more economical furnace design, with no need for convection surfaces . . . burns many fuels you used to throw away . . . results in consistently higher through-put . . . boosts product quality . . . and minimizes slag.

For more complete details on what the Ljungstrom Air Preheater can do for you . . . for an analysis of the heat-recovery benefits attainable in fuel burning equipment – call or write The Air Preheater Corporation.



Wherever You Burn Fuel, You Need Ljungstrom

The Ljungstrom operates on the continuous regenerative counterflow principle. The heat transfer surfaces in the rotor act as heat accumulators. As the rotor revolves, the heat is transferred from the waste gases to the incoming cold air.

How much fuel do your process units burn *just to keep the stacks hot?* It takes precious BTU's to keep them as hot as they are . . . BTU's that, if recaptured, would be working for you – instead of costing you money.

With the Ljungstrom, much waste heat is recovered from exit gases, transferred to incoming combustion air and funneled back into the furnace. How much fuel does this save? You get an idea when you consider that for every 45-50°F of preheat, your fuel bill drops 1% – and Ljungstrom Air Preheaters now in use preheat air to over 1,000°F.

That's why a Ljungstrom saves you up to 20% of your fuel costs – *one barrel in every five.* In fact, one midwestern refiner reports $74,200 saved in fuel in one year. And after he subtracted the Ljungstrom operating cost, he still wound up the year $64,800 ahead.

The Air Preheater Corporation 60 East 42nd Street, New York 17, N. Y.

Robert A. Christman has been appointed chief chemist for the Mobay Chemical Co. plant under construction at New Martinsville, W. Va. He has been an analytical chemist at the Wm. G. Krummrich plant of Monsanto Chemical Co. and has now taken up his new duties with the Mobay research group at Anniston, Ala., until the plant is completed later in 1955. As chief chemist Christman will be in charge of the control and analytical laboratories at New Martinsville.

He was graduated from St. Louis University in 1947 with a B.S. degree in chemistry. He joined Monsanto's Krummrich plant as an asst. analytical chemist the same year, and was promoted to an asst. laboratory supervisor in 1949. He became laboratory supervisor in 1952 and in 1955 was assigned to the development section of the analytical laboratory.

L. G. Dean has been promoted from research and development engineer to laboratory project leader at Dow Chemical Co.'s Freeport, Tex., works.

W. E. Larson, formerly laboratory project leader, has been appointed laboratory group leader.

Recent additions to the technical staff at Freeport include **K. W. Minix,** who holds a B.S. in chemistry from the University of Texas, to the light hydrocarbon dept. as a chemist; **G. E. Gaumer,** B.S. in chemistry from the College of Charleston, to the organic process development laboratory; and **J. E. Lastovica, Jr.,** to the organic process development laboratory as a research and development engineer. He holds a Ph.D. in chemical engineering from Virginia Polytechnic Institute.

PETROLEUM'S FIRST SCIENTIFIC RECOGNITION, a report of a chemical analysis by Prof. Benjamin Silliman of Yale University, had its 100th anniversary celebrated at the API Division of Refining's Midyear Meeting. Here Yale's Prof. Barnett F. Dodge, left, receives a plaque marking the event from API's E. B. McConnell, vice-president for refining, middle, and Harold G. Osborn, vice-chairman of the division's general committee. Silliman's estimates led to the drilling of the first commercial oil well in 1859 by Col. Drake.

Mr. Boyer

Mr. Hussey

Marion W. Boyer, executive vice-president of Esso Standard Oil Co., has been elected to the board of directors of Standard Oil Co. (N. J.). Boyer began in the oil industry in 1927, when he joined Esso Laboratories at Baton Rouge as a chemical engineer. He became head of the laboratories in 1930, and a year later head of the technical service div. of the Baton Rouge refinery. He was appointed general superintendent of the plant in 1933, and was elected to the board of what was then Standard Oil of Louisiana in 1935. The following year he became a vice-president.

In 1945 Boyer was appointed head of all Baton Rouge operations, and in 1949 was transferred to New York to assume responsibility for all manufacturing operations of the Esso Standard Oil Co.

Boyer attended Georgia School of Technology from 1919 to 1921 and spent the next two years as an instructor in science and mathematics at an Indiana high school. He then went to Massachusetts Institute of Technology and took a B. S. in chemical engineering there in 1925 and an M. S. in 1926, after which he joined the school's research laboratory of applied chemistry, where he remained until beginning with Esso.

Daniel Hussey, returned from temporary assignment as general manager of the Abadan refinery in Iran, has been appointed asst. general manager of the Esso east coast manufacturing div. He was general superintendent of the Bayway refinery until he left for Iran last September as head of the refinery survey party that made recommendations for increasing the plant's output once it was put back on stream. A month later he became the general manager and member of the board of the Iranian Oil Refining Co.

A 1925 graduate of Worcester Polytechnic Institute, Hussey began with Esso the same year as a student engineer. He became head of chemical products in 1943, process superintendent of Bayway in 1945, asst. general superintendent in 1951, and general superintendent in 1953.

Luther B. Martin has been appointed associate manager of the Esso Research and Engineering Co. unit located at the Bayway refinery. Martin was the unit's asst. manager and has been with the company since 1925. He is a graduate in civil engineering of Worcester Polytechnic Institute.

Sterling P. Blumberg has been promoted to senior research chemical engineer in the research and development div. of Humble Oil and Refining Co.'s Baytown refinery. Blumberg joined the company in 1943 directly after taking his B.S. in chemical engineering at the University of Texas. The division also has appointed **C. J. G. Leesemann** a research associate. Leesemann is chairman of the refining patent committee and is also responsible for the application of new mathe-

matical techniques and machine computations to the solution of research problems. He received his B.S. in chemical engineering from Rice Institute in 1940.

I. D. Hall and **P. N. Kuehler** have been appointed technical associates in the technical service div. Hall, who holds a B.S. in chemical engineering from the University of Texas, was selected in 1944 to head the technical staff at the government-owned butadiene plant at Baytown. He served for eight years as head of various sections in technical service.

Kuehler has held various supervisory positions in the technical and research divisions. He holds a M.S. in chemical engineering from the University of Tennessee. Both men are now serving in Humble's executive development program as assistant division heads of technical service.

W. A. McElhannon has been promoted senior civil engineer and **R. E. Kappler** to mechanical engineer in the design dept., engineering div., of the refinery. McElhannon holds a B.S. in civil engineering from Louisiana State University. Kappler was graduated from the University of Texas with a B.S. in mechanical engineering.

In the research and development div. of the refinery **John P. Peet** has been promoted to senior research chemical engineer. He came to the company in 1948 after receiving a B.S. in chemical engineering from Rice Institute. **Nick P. Peet** has been made a senior technical specialist in the technical service unit at Baytown. He has been with Humble since 1941, when he was graduated from Rice Institute with a B.S. in chemical engineering.

Charles M. Hickey, manager of manufacturing for Consolidated Chemical Industries, Inc., has been appointed vice-president. Hickey has been with Consolidated since 1924 and employed successively as chemist, engineer, plant superintendent, general superintendent, and southern div. manufacturing plant manager.

Hubert C. Snowden has become the new general superintendent of the

Maintenance Service that knows no holidays

Anywhere . . . any hour of any day, any night, Sundays or holidays . . . you can summon a CONSECO crew of experts for fast retubing, repair or maintenance of any tubular equipment, as well as metal spraying. They'll come fast . . . fully equipped with special tools and all the supplies you may need, drawn from our vast stocks of tubes, tube sheets, and specialties.

CONSECO SERVICE is as near as your telephone. Simply call Maintenance Department.

CONDENSER SERVICE & ENGINEERING CO., INC. CONSECO

Designers and Builders of Equipment for Power, Refining, Chemical and Marine Industries

54 Bloomfield Street
HOBOKEN, N. J.

Equipment Designed and Built by CONSECO

Conseco and its subsidiaries design, build, and install power and processing equipment and accessories, some of which are listed here. Purchasers of Conseco equipment benefit from our maintenance division's quarter century experience in rebuilding, modernizing, and maintaining our own as well as competitors' equipment This coordination assures easy accessibility for maintenance and low operating cost. Send for bulletins covering equipment in which you are interested.

HEAT EXCHANGERS
CONDENSERS
EVAPORATORS
STEAM JET AIR EJECTORS
STEAM GENERATORS
PRESSURE VESSELS
CENTRIFUGES
FILTERS and STRAINERS
PUMPS, INSTRUMENTS, SPECIALTIES

for ACID-PROOF TANKS
SAUEREISEN

Years of dependable service in leading steel mills, chemical plants, etc. A type for every acid proofing use.
Trial Order 10 lb. lot $3.30
Sauereisen Cements Company · Pittsburgh 15, Pa.

(To obtain more data on advertised products see page 1056)

SHELL REPORTS

A PICTURE ROUNDUP OF SOME ACTIVITIES THAT MADE NEWS OUTSIDE THE PETROLEUM WORLD

PIPE RIDE. Poling for submerged roots, this oil "gondolier" rides one-mile sections of the Norco-to-Baton Rouge pipeline through 11 miles of mushy cypress swamp. Pipe lengths are welded on broad wooden islands in the swamp and then floated forward slowly through dense, snake-infested undergrowth. Now "on-stream," the new Louisiana line will help Shell speed more products to market for everybody.

SQUEEZE PLAY. This new lift truck developed by Shell grabs loads by the sides instead of lifting from below. With selected control pressures, it totes drums, cartons, rolls, bales and barrels—safely and quickly. This new technique reduces the cost of frequent package transfer, and helps Shell keep the cost of petroleum products down.

FULL HOUSE. Since 1939, forty-one foster children have lived and laughed and been loved in the home of "Mom" and "Pop" Craig. Because their own four daughters were at college or faraway jobs, the Allen Craigs opened their home to a parade of less fortunate children. Today Al is retired after 28 years with Shell. But the Craigs are still on active duty as foster parents in their home at Meiners Oaks, California—and loving every minute of it. Their 25 years of kindness in the troubled lives of 41 young people makes Shell proud of its long association with two wonderful people—"Mom" and "Pop" Craig.

(To obtain more data on advertised products see page 1056)

southern div., replacing **J. C. Crowder,** who has moved to San Francisco headquarters as vice-president and general manager of west coast and east coast operations. Snowden joined the company as a chemist in 1929. He has worked as chief chemist in the Houston plant, asst. plant superintendent of the Houston sulfuric acid plant, and manager of the Houston plant.

The new manager of the Houston plant is **O. D. Massey,** formerly manager of the Ft. Worth plant. Massey began with Consolidated as an engineer in 1939. He also has been chief chemist of the Houston plant and asst. superintendent of the sulfuric acid unit. He has been succeeded at Ft. Worth by **J. A. D. Todd,** who has been with the company since 1940.

Oswald Newell, Jr., Continental Oil Co., has received the 1955-56 Sloan Fellowship for study at Massachusetts Institute of Technology. The fellowship runs one year, until June of 1956. The award was founded in 1938 with the purpose of affording young technical executives training in the broader phases of industrial management.

Newell received both his bachelor's and master's degrees in chemical engineering from the Georgia Institute of Technology. He joined Conoco at Ponca City following his graduation in 1948 and was promoted to process engineer in 1951. He has been senior process engineer in the manufacturing dept. since 1952.

Paul L. Davis, president of Food Machinery and Chemical Corp., has become the president and chief executive officer of Petro-Tex Chemical Corp., a new organization formed to operate the 90,000-ton butadiene facility at Houston that was recently purchased from the government. Petro-Tex is owned jointly by Food Machinery and Chemical Corp. and the Tennessee Gas Transmission Corp. **Gardiner Symonds,** president of the latter firm, is Petro-Tex's chairman.

Managing director is **Joseph R. Mares,** formerly Monsanto Chemical Co. vice-president and a chemical consultant. **Gordon A. Cain,** until recently assistant to the manager of FMC's Westvaco Mineral Products Div., has been appointed vice-president and treasurer.

Other TGT people in the new organization are **R. V. Mertz,** who was superintendent of TGT compressor stations, and **J. P. Lockwood,** previously with the treasurer's dept. Mertz is a vice-president and Lockwood is secretary and asst. treasurer of Petro-Tex.

Frank J. Smith, manager of the petrochemical div. of the American Oil Co., has been elected vice-president and general sales manager, a director and member of the executive committee of Pan American Chemicals Corp., a newly formed subsidiary. The subsidiary has been formed to market petrochemicals manufactured at the Texas City plant of American Oil.

Mr. Smith

Smith will continue to make his headquarters in New York, where he moved when he became the head of the chemicals div. in 1947. He is a graduate chemical engineer of the University of Illinois. He joined the company as asst. director of research at Texas City in 1942.

PHOENIX *Drop-Forged* FLANGES MEAN . . .
MAXIMUM STRENGTH

Long life is assured with Phoenix maximum strength flanges. Forged of mild steel, they are available in a wide range of styles and sizes. Meet ASA requirements and ASME and ASTM specifications.

NEW CATALOG!
Send for free brochure showing Phoenix Complete Line.

FLANGE DIVISION
PHOENIX MANUFACTURING CO.
Catasauqua, Pa. • Joliet, Ill.

FOR EFFICIENT FILTER OPERATION
Switch to
ANTHRAFILT
Trade Mark Reg. U.S. Pat. Off.

"the modern filter medium"

USED BY MANY LEADING OIL COMPANIES FOR:

- Filtration of Water for Repressure Pumping.
- Filtration of Sanitary and Cooling Water Supplies.
- Filtration of Spent Doctor and Process Wash Waters.
- Boiler Feed Water Supplies.
- Removal of Oily Condensates.
- Prevention of Pollution by Refinery Wastes.

ANTHRAFILT can be used in any filter requiring a filter media. Get the benefit of higher rates, longer runs and lower backwash requirements, along with a better quality of filter effluent.

ANTHRAFILT, being essentially a pure carbon, is not affected by acid or alkaline solutions.

Additional Information, Recommendations and Quotations Furnished on Request By:

PALMER FILTER EQUIPMENT CO
P. O. Box 1696—822 E. 8th St., Erie, Pa.
Representing ANTHRACITE EQUIPMENT CORP.
Anthracite Institute Bldg., Wilkes-Barre, Pa.

Blending WARREN natural gasoline with your present high quality motor fuel will give it

RETAINED VOLATILITY!

Like a summer-time gift from Santa...

THE PEP

STAYS IN THE "PACKAGE"
NOT TO BE RELEASED UNTIL
IT REACHES THE CUSTOMERS' ENGINES . . .

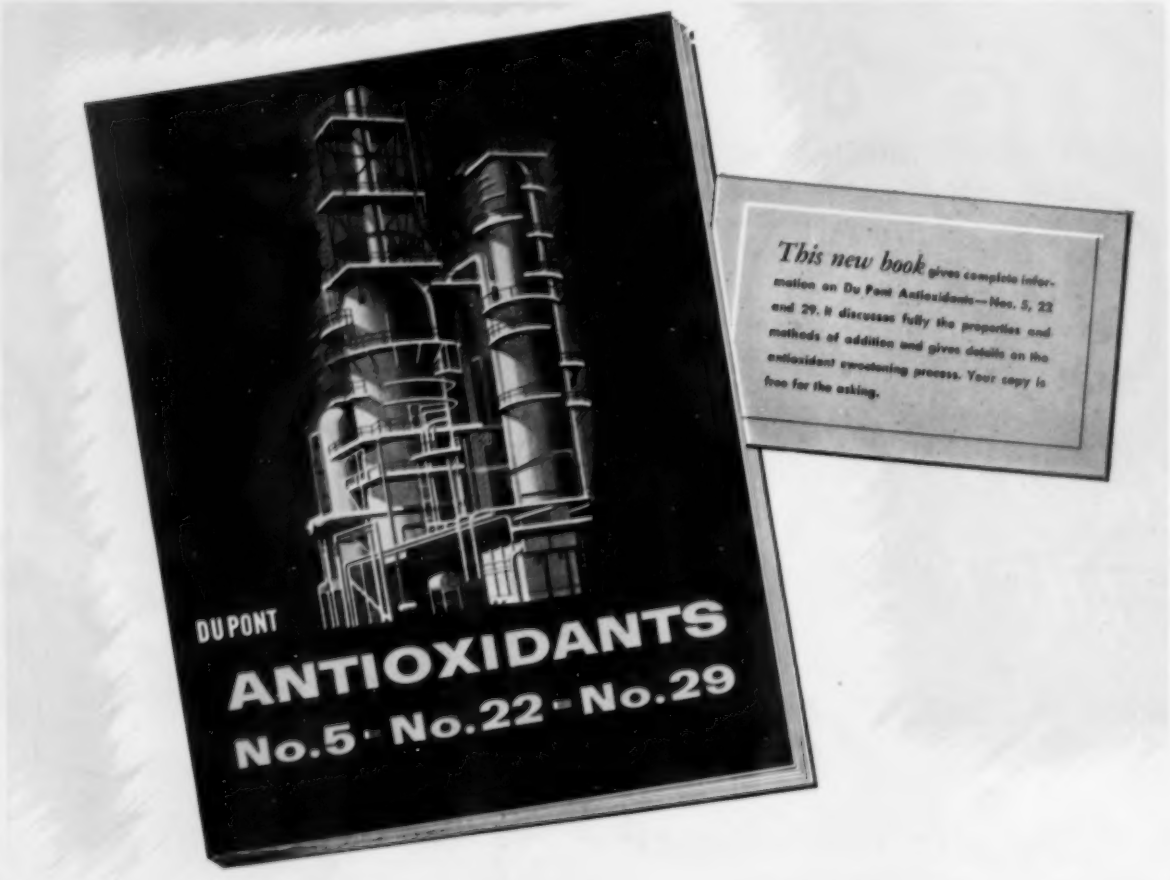
You can depend on Warren's production, transportation, storage and SERVICE for the grade and quantity of NATURAL GASOLINE you need — when and where you want it.

WARREN

PETROLEUM CORPORATION

TULSA, OKLAHOMA • Cable Addresses: STAVOLENE, WARREN

EXPORT TERMINALS: CORPUS CHRISTI, PORT ARTHUR, BAYTOWN, TEXAS CITY AND WARRENGAS, HOUSTON, TEXAS, SAN PEDRO, CALIF.


DU PONT
ANTIOXIDANTS
No.5 · No.22 · No.29
This new book gives complete information on Du Pont Antioxidants—Nos. 5, 22 and 29. It discusses fully the properties and methods of addition and gives details on the antioxidant sweetening process. Your copy is free for the asking.

Are you taking full advantage of Du Pont's services in connection with *antioxidant problems?*

Different gasoline stocks tend to vary in their response to antioxidants. Because of this, maintaining maximum efficiency in all your antioxidant treating operations is a continuing problem. That's why the Du Pont Petroleum Chemicals Division offers these helpful services in connection with the antioxidants we supply.

Regional Laboratory Evaluations—Before making any recommendations, one of our five conveniently located regional laboratories will be glad to study your antioxidant needs carefully. Their analysis covers the economic as well as the technical aspects of your problem.

Technical Assistance—Antioxidant problems cannot always be economically solved by laboratory analysis alone. Sometimes, in order to do the job efficiently, a major change in the treating process is called for. Because our technical representatives have had broad experience in many phases of additives work, they are often in the best possible position to help you solve a specific problem of this sort.

Du Pont Antioxidant No. 22 offers you several outstanding advantages. It is economical to use because it is both an antioxidant *and* a sweetening agent. It is highly effective in both motor and aviation gasolines and is almost completely insoluble in water or caustic. It is the only antioxidant offered for shipment in tank cars. This enables you to save about 6% on its cost.

But our recommendations are not confined to the use of any one antioxidant. The Du Pont Petroleum Chemicals Division offers *three* different types. Du Pont Antioxidant No. 5 is 50% N-normal butyl-para-aminophenol. No. 22 is N, N'-di-secondary butyl-para-phenylenediamine. No. 29 is 2, 6-di-tertiary butyl-4-methyl-phenol.

For more information about Du Pont Antioxidants and the services behind them, just get in touch with any of our representatives at the regional offices listed below. You'll find them eager to help you get maximum efficiency at the lowest possible treating cost.

DU PONT
REG. U.S. PAT. OFF.
Better Things for Better Living
. . . *through Chemistry*

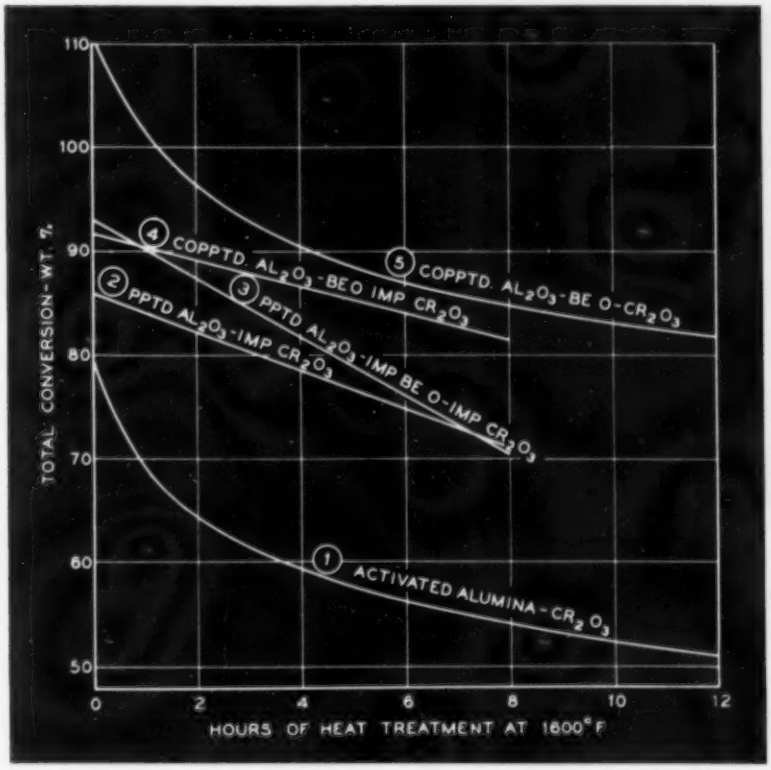
Petroleum Chemicals

E. I. DU PONT DE NEMOURS & COMPANY (INC.)
Petroleum Chemicals Division • Wilmington 98, Delaware

Regional Offices:
NEW YORK, N. Y.—1270 Ave. of the Americas . Phone COlumbus 5-2342
CHICAGO, ILL.—8 So. Michigan Ave . . . . . Phone RAndolph 6-8630
TULSA, OKLA.—P.O. Box 730 . . . . . Phone LUther 5-5578
HOUSTON, TEXAS—705 Bank of Commerce Bldg. . . Phone CApitol 5-1151
LOS ANGELES, CALIF.—612 So. Flower St. . . . . Phone MAdison 5-1691

IN CANADA: Du Pont Company of Canada Limited—Petroleum Chemicals Division—80 Richmond Street West, Toronto 1, Ontario
OTHER COUNTRIES: Petroleum Chemicals Export—Nemours Bldg., 6539 Wilmington 98, Delaware

By Peter J. Gaylor, Patent Attorney, Elizabeth, N. J.



COPRECIPITATED CATALYSTS (4 and 5) show better performance in the dehydrogen tion of butane to butene than older types (1, 2 and 3)

Coprecipitated Catalysts Claimed Superior in Dehydrogenation

AMONG the catalysts used for catalytically dehydrogenating saturated hydrocarbons are the metal oxides of the sixth group of the periodic table. Their activity is improved by supporting them on carriers such as alumina, magnesia, silica-alumina, zirconia and thoria. Beryllium compounds have a promoting effect on the reaction.

In U. S. patent No. 2,706,741, California Research Corp. describes the preparation of a superior catalyst, line 4 in the illustration, having a coprecipitated alumina-beryllia base with chromia being disposed on the base, as follows:

A mixture of aluminum chloride and beryllium chloride was made by adding 12 l. of 30% aluminum chloride (equivalent to 1800 g. of Al_2O_3) to 2.66 l. of beryllium chloride (equivalent to 200 g. of BeO) and then diluting with H_2O to a total volume of 26 gel. Concentrated ammonium hydroxide was added to this mixture with vigorous stirring, until a pH of 9 was reached. The coprecipitate of aluminum hydroxide and beryllium hydroxide formed by the addition of ammonium hydroxide was separated from the solution by filtration and then was pressed to remove entrained solution. Thereafter the pressed coprecipitate in gel form was repulped and washed with 25 gal. of H_2O, three times. The washed coprecipitate (wet gel) was dried in an oven for about 24 hours at 220° F. The dried precipitate (gel) was ground to pass through an 80-mesh screen, then mixed with 3% by weight of pelleting lubricant and pelleted into 5/16-in. diameter pellets. The pellets were calcined for four hours at 1300° F., cooled, and dipped in a 40% chromic-acid solution, allowed to soak until impregnation was uniform and complete, dried as before, and calcined for five hours at 1300° F.

Inspection of this catalyst showed that it contained 20.1% chromia, 8.0% beryllia, and 71.9% alumina.

A coprecipitated alumina-beryllia base catalyst, line 5, impregnated with chromic acid while the base was in a wet gel form is prepared as follows:

A quantity of coprecipitated base containing 6% beryllia and 94% alumina was prepared by the method presented in Example 4. The washed coprecipitate (base) was mixed with a calculated amount of a concentrated chromic-acid solution (the amount sufficient to give a finished catalyst containing 15% chromia). The slurry which was formed upon the addition of the chromic acid was dried in an oven for 24 hours to expel chemically uncombined water. The dried material was broken into 4 to 8-mesh granules and calcined for five hours at 1300° F.

Inspection of this catalyst showed that it contained 15% chromia, 5% beryllia and 80% alumina.

The illustration shows the activity of these two catalysts (4 and 5) when compared with previously known catalysts (1, 2 and 3) in the dehydrogenation of butane to butene, the superiority being particularly demonstrated after heat treatment of the catalyst for four hours at 1600° F. Superiority with respect to overall dehydrogenation activity, improved dehydrogenation selectivity and lower coke production are claimed.

Shear Heating Oil Sediment To Reduce Filter Clogging

OWING to the desirability of virgin heating oils as feed stocks to fluid catalytic cracking units and as Diesel fuels, there is a strong trend toward using catalytically cracked stocks in commercial heating oils. It is well known that when they are blended with unsweetened virgin heating oils, they tend to cause clogging of filters, orifices or conduits associated with burning systems in which they are employed.

In U. S. patent No. 2,703,307, Esso Research and Engineering Co. points out that little is known concerning the mechanism by which sediment is formed in a heating oil. It does appear, however, that the smallest unit particles are in the micron range, i.e., in the order of 5 microns or less. These unit particles agglomerate to become large enough to plug the minute passageways and orifices present in an oil burner.

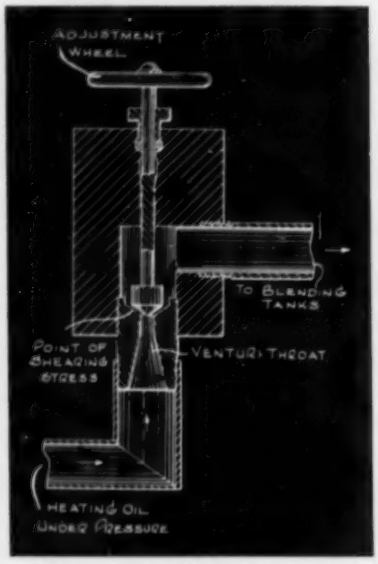
According to this patent, the solid particles comprising "sediment" in do-

mestic heating oils are rendered innocuous with respect to plugging by forcing the oil through the extremely small openings of a conical valve with a pressure of 3000-5000 psi. The shearing stress induced reduces the particle size from upwards of 2-3 microns diameter to less than 0.3 micron. The illustration depicts a type of valve which may be employed for such purpose.

The following example is given of the type of results which may be expected by such treatment:

An oil having a high content of suspended solids (3 mg. or better per 100 ml.) was pumped through a filter. After feeding 8.8 liters of the oil through the filter, the run was stopped because of plugging as indicated by the high pressure differential which developed across the filter. The total weight of sediment collected on the filter after feeding the 8.8 liters of oil was 44.6 mg. At this rate, feeding 12 liters of the oil would have resulted in about 61 mg. of sediment.

For the second run, similar oil with a like amount of sediment was homogenized twice-through at 4000 psi. in a Gaulin 2-stage homogenizer, manufactured and sold by the Manton-Gaulin Manufacturing Co., Everett, Mass. Actually the suspended sediment after homogenization was 3.3 mg./100 ml. This run was made feeding 12 liters of stock and resulted in a final pressure differential of 40.1 cm. Hg.; the weight of sediment collected on the filter pad was 41.1 mg. These results of sediment weight and pressure differential are indicative of non-plugging performance in actual oil burners.



SHEARING VALVE will reduce size of sediment in fuel oil

The claims specify fractionating a petroleum crude oil, caustic washing the heating oil fraction, sweetening the caustic washed fraction, cracking the gas oil fraction, fractionating out a cracked heating oil fraction and caustic-washing it, homogenizing the caustic washed cracked fraction by forcing it through a small opening under a shearing pressure of 1000-8000 psi., and mixing it with the caustic washed uncracked heating oil fraction.

Phenol-Ethanolamine For Lube Extraction

ACCORDING to the Phillips Petroleum Co., patent No. 2,645,-596, extraction of light lubricating oils with phenol has a number of disadvantages, among which is the fact that anhydrous phenol is a solid mass at 107° F., and since a temperature of 110°-175° F. would have to be used, a substantial proportion of the paraffin constituents would be dissolved, thereby reducing the yield. Injection of water results in formation of a corrosive liquid which would require additional facilities in the recovery system for dehydrating the phenol.

The patent discloses the use, as a solvent, of a mixture of 10 parts phenol with one part ethanolamine as the solvent. One example involving extraction of an SAE 10 dewaxed raw Mid-Continent oil of 71 V. I. in a single stage at 150° F. with equal volume of solvent gave an 80% yield of raffinate of 81 V. I., compared to a 70% yield of an 82 V. I. raffinate obtained with anhydrous phenol.

Monoisopropylamine Cited As Octane Improver

MONOISOPROPYLAMINE is claimed to have value as a fuel component even in small quantities, because of its excellent octane number and supercharge rating when compared to hydrocarbon material. In patent No. 2,653,862, Phillips Petroleum Co. proposes the addition of 1 to 20% by volume of the chemical to leaded gasoline. Engine data are given in the patent.

Sulfur Corrosion in Fuels Countered by Metallic Salt

IT HAS been observed that when internal combustion engines are operated with fuels of relatively high sulfur content they exhibit much more corrosion on the metal portions in contact with products of combustion. This is true regardless of whether the sulfur is in the free or combined state. However, the presence of sulfur has a beneficial effect in that ignition properties of the fuel are improved.

In U. S. patent No. 2,673,145, issued to Shell Development Co., it is claimed that by the incorporation of a small amount of metallic inorganic salt into the diesel fuel the corrosion of the metal parts is practically completely eliminated or substantially reduced. Also, engine deposits are said

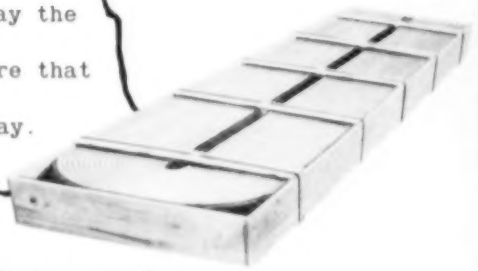
VESSELS ASME CODED
Complete design, engineering and fabricating facilities for buildings, pressure vessels, stacks, barges, staging.
THE ST. MARY STAMP IS THE STAMP OF SUPERIORITY
COMPLETION AS PROMISED!
DESIGN
ENGINEERING
FABRICATION
BY ST. MARY IRON WORKS
ST. MARY IRON WORKS
FRANKLIN, LOUISIANA - U. S. A.
Steel Fabricators for Half A Century

WHAT

~~The Warwick Petroleum Corporation~~

had to say about Wolverine U-Bend Pallets for Condenser Tubes

. . . Our shop was very pleased with the way the U-bends were packed and expresses the desire that all future shipments be handled the same way.



We asked for *more* information—and this is what we got!

From the Chief Engineer . . .

Q. Mr. ~~Hammond~~, in your opinion, what is the big advantage of Wolverine U-bend palletized condenser tubes?

A. The fact that condenser tubes are shipped to us in an orderly fashion. We used to have dozens of different bends in stock and when we had to retube we had to spread the various tubes out on the floor in front of the condenser. In other words, we needed a lot of space and had to do a great deal of time-consuming handling.

Q. And how did the U-bend pallet help?

A. Now, we just set the pallet in front of the condenser and remove the tubes as needed. They are arranged on the disposable box-type pallet in the exact order we need them—right to the prints we supplied Wolverine's Field Engineering Service. We save time, space and money. Another thing, our inventory situation is eased. We just stock complete tube installations and use them as needed.

Q. What other factor did you find helpful?

A. Wolverine provides a direct mill source of supply for all our U-bends, fin condenser tubes and plain condenser tubes. All our requirements can be handled directly with Wolverine.

Q. Were there any other indications of savings?

A. Yes. The U-bends decreased unit costs by eliminating one tube sheet and at the same time cut our rolling-in operations in half.

Q. How about performance?

A. We found that the individual tube bends took care of differential expansion and eliminated floating head problems.

These extraordinary conveniences of Wolverine U-bend palletized condenser tubes can be yours too. Wolverine supplies both prime surface and finned tube *palletized* in a wide range of alloys and sizes in copper, aluminum and electric-welded steel. Look into this opportunity to save! Write for Wolverine's Condenser Tube Book. WOLVERINE TUBE, 1441 Central Avenue, Detroit 9, Michigan.

WOLVERINE TUBE
DIVISION OF CALUMET & HECLA, INC.
Manufacturers of Quality Controlled Tubing and Extruded Aluminum Shapes

PLANTS IN DETROIT, MICHIGAN AND DECATUR, ALABAMA. SALES OFFICES IN PRINCIPAL CITIES.

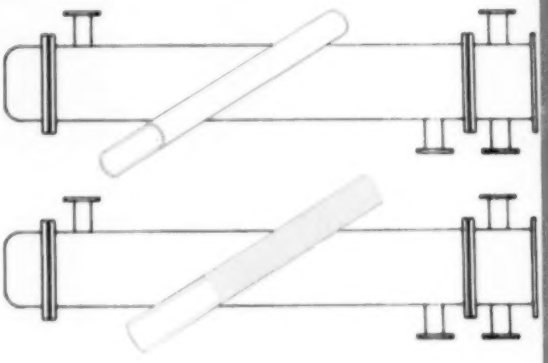
EXPORT DEPT., 13 E. 40TH ST., NEW YORK 16, N. Y.

HOW

An opportunity to cut oil cooler costs—Number 7 of a Series

[redacted]

BOOSTED BTU/HR OUTPUT OF OIL COOLERS



When [redacted] of [redacted] shifted from Prime surface condenser tubing to Wolverine Trufin® Type S/T condenser tubing for their oil cooler installations two startling facts showed up right away.

BTU/HR OUTPUT SOARED—

COSTS PLUMMETED!

Reasons were amazingly simple. Trufin, because it is a finned tube, provided up to twice as much outside surface area for heat transfer. And, because the fins and the tube wall were all one piece—integral—they stood up under the stress and strains of vibration, pressures and temperature changes. This meant more on-stream time—dependable performance for [redacted] Trufin's heat transfer performance was much higher than plain tubing. Results—more BTU's/Hr in the same unit at reduced costs.

®REG. U.S. PAT. OFF.

Here are the facts:

	Trufin Condenser Tubing	Plain Condenser Tubing
Tube Specifications	¾" Admir. Trufin Condenser Tubing	¾" Admir. Plain Condenser Tubing
Length of Tube Bundle	48 inches	48 inches
Shell Diameter	8 inches	8 inches
No. of Tubes in Bundle	50	50
Total Outside Surface Area	79 sq. ft.	38 sq. ft.
Shell Side Fluid	Oil	Oil
Tube Side Fluid	Water	Water
Shell Side Flow Rate	39,200 lb./hr.	37,430 lb./hr.
Heat Transfer Duty	284,000 BTU/HR.	192,000 BTU/HR.

Trufin saves dollars on the new installations at [redacted] because smaller heat exchangers can be designed—that means less tube, smaller shells and headers.

Selection can be made from a wide range of sizes in copper, copper-base alloys, aluminum and electric-welded steel. Write for a copy of the Wolverine Opportunity Book. It's proof positive that Trufin will do a job for you! Wolverine Tube, 1441 Central Avenue, Detroit 9, Mich.

Investigate Today —and Save!

Wolverine Trufin is available in Canada through the Unifin Tube Company, London, Ontario

WOLVERINE TUBE

DIVISION OF CALUMET & HECLA, INC.

Manufacturers of Quality-Controlled Tubing and Extruded Aluminum Shapes

These installation photos show the new

to be reduced so that the corrosion and deposition are comparable to those encountered in a fuel containing low or negligible quantities of sulfur.

One engine test of 80 hours duration showed a reduction of total ring wear by 50% by injection of an isopropyl alcohol solution of calcium nitrate into the air intake system at a rate of 0.6 cc./min., using a fuel containing 0.7% S, the amount of salt consumed being equivalent to about 0.022% of the fuel used. Other examples disclose similar results with zinc nitrate and magnesium nitrate. The patent claims appear broadly to cover use of a hydrated base metal inorganic nitrate.

Patents Issued in May

The following classified listing gives the patent number, patentee, or assignee, and a brief description of all patents believed to be of interest to the petroleum processing industries, as contained in the Official Gazette of the U. S. Patent Office for May 3, 10, 17, 24, and 31, 1955, Vol. 694, Nos. 1-5.

PROCESSES

Refining

2,707,698 (Hydrocarbon Research, Inc.) Gasoline desulfurization with hydrogen and alumina.
2,707,699 (Hydrocarbon Research, Inc.) Removal of thiophenes from aromatic hydrocarbons, using hydrogen and alumina.
2,707,700 (Hydrocarbon Research, Inc.) Gasoline gum-former removal using hydrogen and alumina.
2,708,652 (Sun Oil Co.) Wax refining with clay.
2,708,983 (Phillips Petroleum Co.) Recovery of elementary sulfur from gases by condensation.

Conversions

2,707,675 (Institute of Gas Technology) Method of preparing fuel gas interchangeable with natural gas, by cracking at 1460°-1540° F. and 3-4 atm. and scrubbing to remove aromatics.
2,707,702 (Sinclair Refining Co.) Art of coking, using dense fluidized bed.
2,708,180 (Badische Anilin- & Soda-Fabrik A. G.) Carrying out catalytic reactions with hydrocarbons in the presence of hydrogen and artificially prepared silicate catalyst with water glass carrier.
2,708,621 (Hercules Powder Co.) Injection means for hydrocarbon cracking.
2,708,682 (Esso Research & Engineering Co.) Polymerization of olefins with fluid slurried catalyst.
2,709,151 (Badische Anilin- & Soda-Fabrik A. G.) Recovery of gasoline from petroleum oils or crude residues by destructive hydrogenation and passing over de-ashing substance and fixed bed catalyst.
2,709,152 (Koppers Co., Inc.) Process for producing finely divided coke from bituminous fuels.
2,709,153 (Roman Rummel) Carbonization and gasification of bituminous material.
2,709,159 (Esso Research & Engineering Co.) Activating carbon monoxide conversion (water gas shift) catalyst.

Hydrocarbon Synthesis

2,707,706 (Esso Research & Engineering Co.) Method of reducing iron catalyst.
2,707,713 (Esso Research & Engineering Co.) Hydrocarbon synthesis, using fluidized system.
2,708,674 (Esso Research & Engineering Co.) Process for the synthesis of hydrocarbons employing a hydrogen-sintered pyrites ash.

PRODUCTS

Chemicals

2,707,714 (Shell Development Co.) Propargyl sulfides and mercaptans and process for preparing same, using copper catalyst.
2,707,716 (Esso Research & Engineering Co.)

J-M BLAZECRETE builds longer lasting refractory linings...

That's why it pays you to use this hydraulic setting refractory for temperatures to 3000F

Blazecrete* linings last longer because they resist spalling, withstand slagging action, and are not harmed by rapid temperature changes.

Thus you cut down on refractory maintenance costs—and you save on labor costs, too, because Blazecrete goes on fast. For troweling, just mix Blazecrete with water as you'd mix ordinary concrete . . . then slap-trowel it in place. When gunned, it adheres readily with a minimum of rebound loss. Either way, Blazecrete may be applied easily without laborious ramming or tamping.

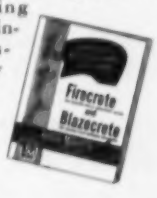
Three types of hydraulic-setting Blazecrete are available. All harden on air curing, do not require prefiring. They are furnished as a dry mix—can be stored safely for use as needed.

3X BLAZECRETE—For temperatures through 3000F. Unusually effective for heavy patching, especially where brickwork is spalled or deeply eroded. Excellent for forge furnace linings, lime kilns, burner blocks, soaking pits, and industrial boilers.

STANDARD BLAZECRETE—For temperatures through 2400F. Makes repair work easier and less costly. Can be used by boiler manufacturers to replace fire clay tile in wall construction. Suitable for use in combination with 3X Blazecrete and L. W. Blazecrete.

L. W. BLAZECRETE—For temperatures through 2000F. An insulating refractory . . . light in weight, low in thermal conductivity. Adaptable and economical for many other applications.

Send for Brochure RC-28A on Blazecrete and its companion material, Firecrete*. . . the hydraulic-setting castable refractory for making special shapes and linings. Write Johns-Manville, Box 60, New York 16, N. Y. In Canada, 199 Bay St., Toronto 1, Ontario.

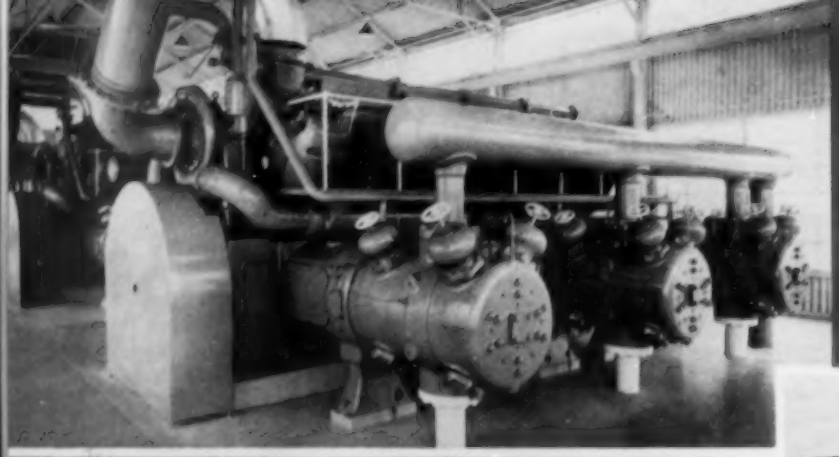


*Reg. U. S. Pat. Off.

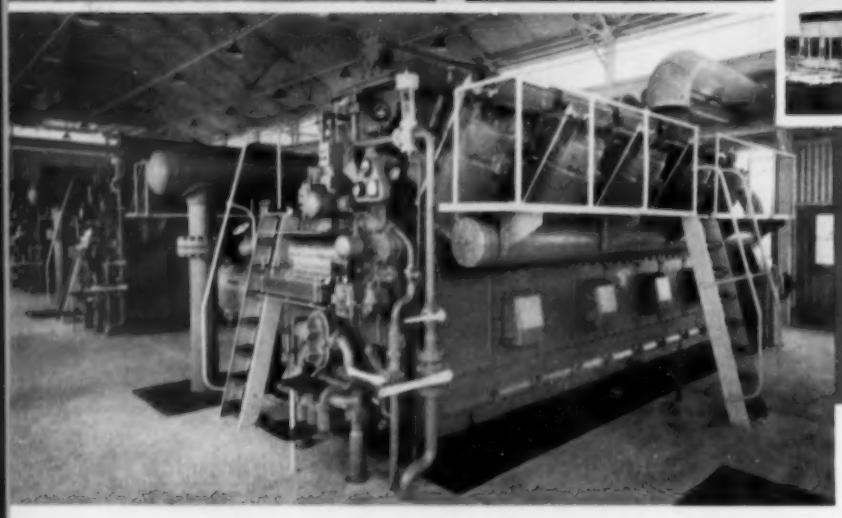
Whether you gun it... *or slap-trowel it...*

Johns-Manville **BLAZECRETE**
BUILDS BETTER REFRACTORY LININGS

(To obtain more data on advertised products see page 1056)



These installation photos show the new Cooper-Bessemer GMVA compressors which are identical in both the Keyes, Oklahoma and Springfield, Colorado transmission stations of the Colorado Interstate Gas Company. Below are exterior views of the compact Keyes (left) and Springfield (right) stations.



Another Example of Efficient Power at Lower Cost

The latest for Colorado Interstate Gas . . .

COOPER-BESSEMER GMVA's

for new highs in compressor performance

● Two important transmission stations of the Colorado Interstate Gas Company have installed new Cooper-Bessemer GMVA compressors with centrifugal blowers.

Both the Springfield, Colorado and Keyes, Oklahoma stations are equipped with four of these big, modern 10-cylinder GMVA's rated 1350 hp at 300 rpm. The GMVA compressor is an *even better, smoother operating* unit than the well-known GMV it replaces.

With the GMVA, there's a 10% reduction in fuel consumption, good air ratio to all loads, higher horsepower ratings with no space increase, operation on a variety of fuels, ample working space around power cylinders . . . and many other advantages that add up to increased compressor operating efficiency and reduced maintenance demands in the 540-1350 horsepower range.

For further information on the dependable and economical GMVA, drop in, or write to any of the conveniently located offices listed below. You'll be especially interested in Cooper-Bessemer's new, complete GMVA Catalog No. 75. Write for your copy today.

MOUNT VERNON, OHIO
COOPER-BESSEMER
GROVE CITY, PENNA.

New York City • Seattle, Wash. • Bradford, Pa. • Chicago, Ill. Houston, Dallas, Greggton, Pampa and Odessa, Texas Washington, D. C. • Shreveport, La. • San Francisco, Los Angeles, Calif. • St. Louis, Mo. • Gloucester, Mass. • New Orleans, La. • Tulsa, Okla. • Cooper-Bessemer of Canada Ltd., Edmonton, Alberta—Halifax, Nova Scotia.

DIESELS • GAS ENGINES • GAS-DIESELS • ENGINE-DRIVEN AND MOTOR-DRIVEN COMPRESSORS

Process of separating C_6 diolefins from higher and lower diolefins.

2,708,154 (Food Machinery & Chemical Corp.) Process for carbon disulfide production from sulfur and hydrocarbon gases.

2,708,179 (Universal Oil Products Co.) Conversion of mercaptans by reaction with beta-dialkylamino ketone.

2,708,185 (Scottish Oils Ltd.) Detergent compositions from sulfated shale oil.

2,708,199 (Continental Oil Co.) Preparation of organic polysulfides.

2,708,204 (Shell Development Co.) Halogen and phosphorus-containing compounds (phosphonic acids).

2,708,208 (Shell Development Co.) Production of phenols from cyclohexanone.

2,708,210 (Continental Oil Co.) Process for dehydrohalogenation of halogenated high molecular weight paraffinic hydrocarbons and catalyst which is pretreated.

2,709,126 (Koppers Co., Inc.) Production of calcium hydrosulfide solutions from lime and H_2S-CO_2-containing gases.

2,709,155 (Esso Research & Engineering Co.) Photochemical sulfo-chlorination.

2,709,173 (California Research Corp.) Oxidation of ethylene to ethylene oxide and catalyst therefor.

2,709,175 (Du Pont Co.) Aldehyde-dicyclopentadienyliron reaction product and method of making.

2,709,183 (Du Pont Co.) Synthesis of aliphatic fluorine compounds from hydrogen fluoride and carbon.

2,709,193-4 (Imperial Chemical Industries Ltd.) Dealkylation of aromatic hydrocarbons, using aluminum silicate-ferric fluoride catalyst.

2,709,195 (Du Pont Co.) Thiophene-converting process to butadiene and butenes.

Catalysts

2,707,701 (Esso Research & Engineering Co.) Method of regenerating fouled catalyst particles employed in the conversion of hydrocarbons.

2,708,186 (Esso Research & Engineering Co.) Processes for the manufacture of silica hydrosols.

2,708,187 (Esso Research & Engineering Co.) Method of stabilizing metal catalysts for naphtha reforming, using HF treated alumina.

2,708,516 (Esso Research & Engineering Co.) Apparatus for separating and classifying finely divided solid materials.

Fuels

2,707,373 (Maynor Research Foundation, Inc.) Liquid fuels turbine and method of operating it without carbonization and erosion by burning hydro-carbon with liquid oxidizer.

2,709,196 (Esso Research & Engineering Co.) Aviation fuel blending agent (triptane).

Lubricants

2,708,182 (Shell Development Co.) Preparation of oil-soluble organic calcium sulfonates.

2,708,659 (Esso Research & Engineering Co.) Method for the preparation of calcium mixed base greases with barium, strontium or magnesium soap.

2,709,156 (Tide Water Associated Oil Co.) Oxidation-inhibited mineral oil compositions, using P-S propenoic acid derivative.

2,709,157 (California Research Corp.) Greases thickened with phenylene diamides.

Specialties

2,707,672-4 (Columbian Carbon Co.) Method of heat treating furnace carbon black.

2,707,705 (Ashland Oil & Refining Co.) Light stable petrolatum containing furfuralazine.

2,708,660 (Sun Oil Co.) Soluble oil rust inhibitors (mercaptobenzothiazole and imidozoline).

Miscellaneous

Re 23,999 (Phillips Petroleum Co.) Fluid velocity responsive regulating or indicating means.

2,707,484 (Phillips Petroleum Co.) Valves.

2,708,946 (Universal Oil Products Co.) Flow control valve regulated by variable air pressure and liquid displacement.

2,709,062 (Shell Development Co.) Portable powered valve operator and valve structure therefor.

EQUIPMENT

Processing, general

2,707,990 (Niro Corp.) Apparatus for drying, concentrating or crystallizing liquid materials.

2,707,991 (Rosenblad Corp.) Heat treating a fluid substance.

2,708,033 (Prater Pulverizer Co.) Pneumatic fractionater.

2,708,156 (Rumanica S.p.A.) Electric furnace for the manufacture of carbon disulfide.

2,708,486 (Research Corp.) Gas-cleaning apparatus.

2,708,487 (Research Corp.) Gas-cleaning apparatus.

2,708,516 (Summit Trust Co.) Apparatus for separating and classifying finely divided solid materials.

CLASSIFIED

THE STANDARD OIL COMPANY (OHIO)

Manufacturing (Refining) Department

is looking for

CHEMICAL ENGINEERS, CHEMISTS, and MECHANICAL ENGINEERS

with one to five years experience in petroleum refining or related activities

for staffwork primarily in Cleveland, Ohio.

Possible employment in Toledo, Lima, or Cincinnati, also.

Applicant should have the following educational background and industrial experience:

Chemical Engineers: B.S. or higher degree and experience in development, pilot plant operation, process design, process trouble shooting, refinery process engineering, economic studies, or related work background.

Chemists: B.S. or higher degree and experience in product and process research or development.

Mechanical Engineers: B.S. or M.S. degree and experience in process equipment construction, design, inspection, or maintenance, petroleum product testing and field evaluation, or related work background.

Age range 22 - 32

Salaries commensurate with experience and level in organization. Advance on merit basis.

If you can qualify and are looking for a permanent job with a growing but secure midwest company, write, giving full information on education, industrial experience, military experience, and personal data to E. G. Glass, Jr., 1737 Midland Building, Cleveland 15, Ohio.

LOOKING FOR ENGINEERS . . . TECHNICIANS?

The petroleum engineers and technicians you want are readers of this publication.

You can make effective contact with just the men with the job qualifications you want through an employment advertisement in this section.

Rate: $13.50 per inch. Contract rates on request. Subject to Agency Commission.

All items listed subject to prior sale or use by Eli Lilly and Company.

9—Podbielniak, Type 316 S.S. centrifugal, multi-stage, counter-current liquid-liquid solvent extractors. 1 Serial #6060, 8 Serial #6070, Engineering data available. Original cost 1947—$12,500 ea. Used. Price $2,500 ea.

1—Buffalo Vac 12" x 18" Drum Drier S.S. Blade and Drum. Used. Price $1,500

3—Devine single door vacuum shelf driers. 6 shelves, 9" apart. 80 square feet effective pan surface. Drawing available. Replacement cost $5,500 ea. New. Price $2,500 ea.

1—Dean Brothers Pump 7 x 7 x 10 Duplex Double Acting Piston Type Pump. Durable S.S. Valve Service. Replacement cost $1,200. New. Price $600

3 Polar Stills, 3 Rotameters, 1 Tapered Tantalum condensor, 1 Copper condensor 24 square feet, 1 Tilting kettle on casters 200 gallon.

All items F.O.B. Indianapolis.

ELI LILLY AND COMPANY

Plant Salvage Department — John H. Compton

740 S. Alabama Street, Indianapolis 6, Indiana

MElrose 6-2211

(To obtain more data on advertised products see page 1056)

Willing to find out*

The Research Division is another facet of Fluor's multi-service operations under a single responsibility. The Research Division designs new or improved processes and products which are offered by Fluor to industry. It conducts laboratory and pilot plant experimental studies to provide technical data to other Fluor divisions and to their customers. It furnishes consulting services in fields of specialized knowledge, and maintains a broad contact with the technical and economic trends of the industries it serves.

SURE WITH **FLUOR**

THE FLUOR CORPORATION, LTD.
LOS ANGELES 22, CALIFORNIA, U.S.A.

FLUOR OF CANADA · TORONTO
HEAD WRIGHTSON · LONDON
AFFILIATES: BINGHAMTER & BREYER, NEW YORK; H. G. ACRES & COMPANY, LTD., NIAGARA FALLS, ONTARIO, CANADA

ENGINEERS
CONSTRUCTORS
MANUFACTURERS

NEW YORK
CHICAGO
PHILADELPHIA
BOSTON
PITTSBURGH
SAN FRANCISCO
HOUSTON
BIRMINGHAM
TULSA
DENVER

There are many practical advantages of dealing with an engineering and construction firm that appreciates the value of research, who has the manpower and facilities to conduct a thorough research program concurrently with engineering and construction (no need to delay a construction project while research is being concluded), and who possesses an unbounded willingness for finding out. For more information on Fluor's Research facilities write for Bulletin FC 8.001R.

* *"Research means you do not know but are willing to find out"* —CHARLES KETTERING

(To obtain more data on advertised products see page 1056)

Patents

2,708,571 (Industrikemiska Aktiebolaget) Apparatus for contacting gases and liquids.
2,708,604 (Union Oil Co. of Calif.) Impactless separator.
2,708,794 (Farbenfabriken Bayer A.G.) Apparatus for drying materials by heat radiation.
2,708,913 (Crotty Mfg. Corp.) Fuel oil preheaters.
2,709,034 (National Research Corp.) High-vacuum device.
2,709,348 (Union Carbide and Carbon) Apparatus for separating gas mixtures.
2,709,424 (Babcock & Wilcox) Vapor generator furnace.
2,709,496 (Socony Mobil Oil Co.) Gas drier.
2,709,575 (Clarence T. Sorensen) Apparatus for heat exchange.
2,709,641 (Universal Oil Products Co.) Extraction column.
2,709,642 (Esso Research and Engineering Co.) Chemical reactor.
2,709,673 (Union Oil Co. of Calif.) Apparatus for solids conveyance in the conversion of hydrocarbons.
2,709,677 (Compagnie Generale de Construction de Fours) Heating devices and heat regenerators of coke ovens.
2,709,678 (Phillips Petroleum Co.) Distillation control system.

Instruments

2,707,391 (Bell Telephone Laboratories) Device for testing viscous liquids.
2,707,393 (Beta Corp.) Apparatus for fluid flow determination.
2,707,394 (Flowflax Corp.) Apparatus for indicating weight and rate of liquid delivered.
2,707,395 (Liquidvision Gauge & Control Corp.) Electric remote reading tank gage.
2,707,396 (Ford J. Dupure) Liquid level sight gage.
2,707,452 (Willie C. Schwartz) Drain gage.
2,707,482 (Rober E. Carter) Electronic liquid level controller.
2,707,487 (Atmorol Corp.) Orifices.
2,707,488 (Willebrordus A.G. Overdijk) Orifice plate.
2,707,833 (Dewey R. Parrott) Liquid level measure.
2,707,879 (F. W. Dwyer Mfg. Co.) Gas pressure differential gage.
2,708,361 (Dobbie McInnes Ltd.) Electrical viscometers.
2,708,365 (Herman Lindars) Apparatus for measuring rate of flow.
2,708,366 (Ora Blocher and Gunther Martin) Apparatus for measuring fluid flow.
2,708,721 (Tracerlab Inc.) Liquid level gage.
2,708,945 (Worthington Corp.) Liquid level control circuit.
2,709,360 (Illinois Testing Laboratories) Dew point measuring apparatus.
2,709,365 (Phillips Petroleum Co.) Flowmeter.
2,709,366 (David M. Potter) Flowmeter.
2,709,755 (David M. Potter) Flowmeter.

Pumps & Compressors

2,707,441 (Commercial Shearing and Stamping Co.) Rotary pump or motor.
2,707,485 (Milton Roy Co.) Pump and valve unit.
2,707,920 (Macajah R. Creasy) Centrifugal pump.

Valves & Fittings

2,707,378 (Phillips Petroleum Co.) Excess flow valve.
2,707,483 (Shafer Valve Co.) Pressure fluid-operated reclosing-type valve.
2,707,484 (Phillips Petroleum Co.) Valves.
2,707,613 (Tomco Supply Co.) Valve assembly.
2,707,940 (George R. Harris) Valve mechanism.
2,707,966 (John F. Taplin) Pressure regulator valve.
2,707,971 (Harper-Wyman Co.) Gas valve.
2,708,071 (Emil Burhop) Mixing valve.
2,708,093 (Felix Leber) Valve operating means with electromagnetic blocking means.
2,708,094 (Joseph Heinen) Plug valve.
2,708,096 (Mueller Co.) Valve devices.
2,708,450 (Karl F. Mauer) Multiple outlet valve.
2,708,452 (Ada I. Tappan) Fluid pressure operated balanced valve.
2,708,561 (AP Controls Corp.) Four-way valve.
2,708,562 (Arthur G. Thomas) Valve plug-retaining device.
2,709,064 (Sinclair Refining Corp.) Valve apparatus.
2,709,455 (Dolphice H. Greenwood) Line blind valve.
2,709,738 (Paul D. Walter) Liquid switch actuated by a permanent magnet.

Miscellaneous

2,707,336 (Myron E. Steczynski) Pipe thread gages.
2,707,377 (Union Stock Yards and Transit Co.) Storage and shipping container for cold liquefied gas.
2,707,480 (Ernst Klosse) Self-proportioning system.

HIGH QUALITY
ANHYDROUS
Aluminum Chloride
PRODUCED IN TWO GRADES
RESUBLIMED & SUBLIMED

THE PUREST COMMERCIAL MATERIAL AVAILABLE

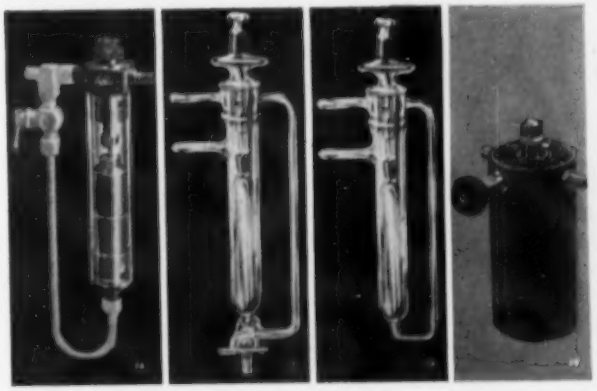
ANY PARTICLE SIZE OBTAINABLE
OUR STANDARD SIZES
POWDER (-20 MESH) GRANULAR (-4+20 MESH) LUMP (-1+4 MESH)

INFORMATION CONCERNING THE PREPARATION of AQUEOUS OR ALCOHOLIC SOLUTIONS OF $AlCl_3$ OBTAINABLE BY WRITING
OHIO-APEX DIVISION
FOOD MACHINERY & CHEMICAL CORPORATION – NITRO, W. VA.

PLASTICIZERS & CHEMICALS — OHIO APEX — fmc

CARTESIAN

for automatic vacuum and pressure control



MANOSTATS

They remember your vacuum setting even after shutting down system! Exclusive with Emil Greiner! No other instruments in the field can compare with these remarkable Cartesian Manostats for sensitivity, accuracy and reliability. Designed on the simple phenomenon of the Cartesian Diver, their construction, installation and operation is uncomplicated and dependable.

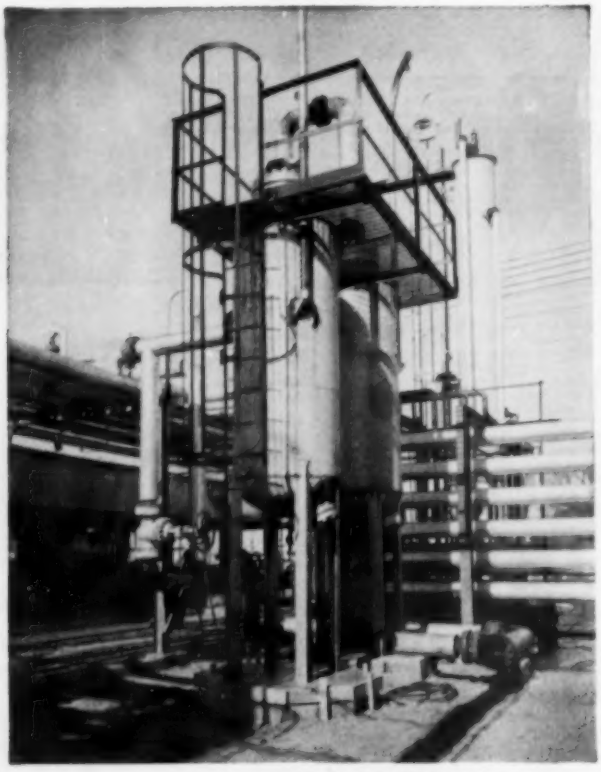
For complete information, write for Constant Pressure and Vacuum Control Bulletin.

The EMIL GREINER Co.
20-26 N. MOORE STREET DEPT. 231, N. Y. 13, N. Y.

The Emil Greiner Co., Dept. 231
20-26 N. Moore Street, New York 13, N. Y.
Please send me Cartesian Manostat Bulletin.

NAME _____
COMPANY _____
ADDRESS _____
CITY _____ ZONE ____ STATE _____

INTERESTED IN UNIFINING* FOR DESULFURIZATION AND UPGRADING



* First Commercial Unifining Unit
United Refining Co.
Warren, Pennsylvania

UNIFINING should be of particular interest to all operators of catalytic reformers which produce by-product hydrogen.

• Harshaw is the exclusive producer of the Union Oil Company of California cobalt-molybdate catalyst used in the recently announced "Unifining" desulfurization and upgrading process. This rugged, commercially proven catalyst is supplied in the form of cylindrical tablets conforming to rigid physical and chemical specifications established by Harshaw and Union Oil Company of California. Stability at high temperatures permits repeated regenerations if and when necessary.

Please contact Harshaw for further information on this catalyst.

HARSHAW

THE HARSHAW CHEMICAL CO.

1945 East 97th Street, Cleveland 6, Ohio

Chicago 32, Illinois • Cincinnati 13, Ohio • Detroit 28, Michigan • Houston 11, Texas
Los Angeles 22, California • New York 17, N. Y. • Philadelphia 48, Pennsylvania
Pittsburgh 22, Pennsylvania

* Trademark of Union Oil Company of California

Fisher Opens Reagent Factory

A plant specifically for the manufacture of reagent chemicals has been constructed at Fair Lawn, N. J., and occupied by Fisher Scientific Co. It has complete facilities for the development, manufacture, analysis and packaging of reagents, as well as 60,000 sq. ft. of warehouse space.

The new plant stocks chemicals for the six other major Fisher warehouses and is connected with them by teletype. One of the plant's special installations is an electronic filling machine that delivers a pre-set quantity, by weight, of a chemical into a bottle, caps and labels the bottle, boxes it and then delivers it to the warehouse.

UC&C Builds Research Lab

A laboratory for basic, exploratory research is being constructed by Union Carbide and Carbon Corp. at Parma, Ohio. Much of the work will be in solid state physics, without reference to any specific practical uses, though investigation and design of materials for industry will be carried on too. Work will be done with metallic and non-metallic compounds of carbon, as well as analogous compounds such as inter-metallics and semi-conductors.

The laboratory is being administered by a Union division, the National Carbon Co. The director is Robert G. Breckenridge, who has worked most recently as chief of solid state physics for the U. S. Bureau of Standards. Previously he was head of physics of the Office of Naval Research.

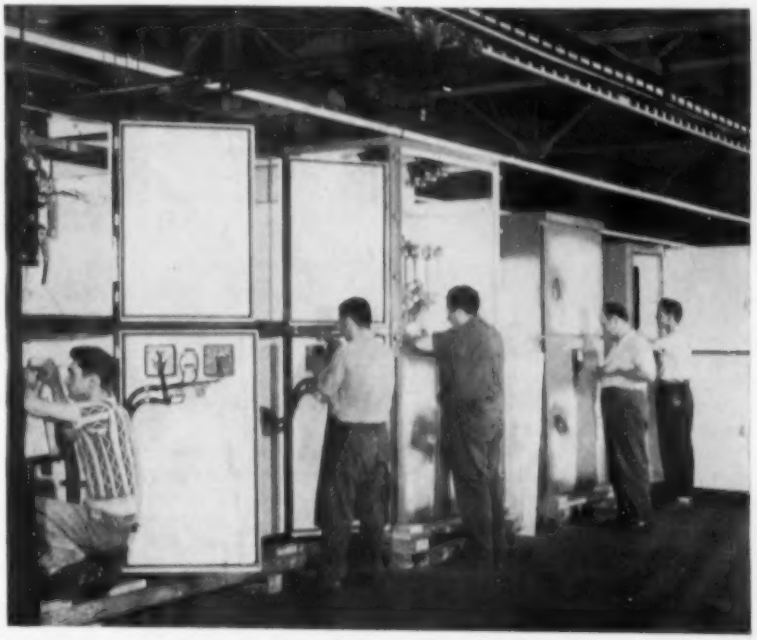
Kaiser Buys Two Steel Plants

Kaiser Steel Corp. has purchased two steel producing facilities of the Basalt Rock Co., a large pipe fabricator in the west. The properties acquired made up the Steel Div. of the Basalt company. One plant is located at Napa, Calif., and the other at Fontana. They employ a total of 800 persons and produce large diameter expanded steel line pipe, medium diameter electric resistance weld pipe, large diameter steel reinforced concrete pipe, and a variety of fabricated steel products.

The Napa plant has two production lines for the manufacture of steel line pipe from 6⅝ to 36 inches in diameter and up to 40 ft. in length. In addition, the plant has fabricating equipment for such products as underground storage tanks, butane and propane tanks, siphons, tunnel liners and other items. The Napa plant is Kaiser's first steel-producing facility in the San Francisco bay area.

Two mills are on the Fontana site, which is in the Los Angeles district. One produces steel reinforced concrete pressure pipe and the other turns out heavy-wall, segmental section steel pipe, as well as welded steel cylinders, steel joint rings and reinforcing assemblies.

Ernest Ilsley, vice-president of Basalt, has joined Kaiser Steel as manager of both the Napa and Fontana plants.



ASSEMBLY LINE OF 2200-5000 V. oil and air-break motor starters at Electric Controller & Mfg. Co.'s new plant in the suburbs of Cleveland. Plant was designed for utmost flexibility, and facilities may be shifted at will. It provides 340,000 sq. ft. of space and cost $4,500,000.

Dr. Goldsby Joins Stratford

Dr. A. R. Goldsby has become director of research for the Stratford Engineering Co., Kansas City, Mo. He was formerly with the National Aluminate Corp., the National Aniline Div. of Allied Chemical, The Texas Co. and Texaco Development Corp. He received his B.A. degree from Illinois College and his M.S. and Ph.D. degrees from Northwestern University.

Dr. Goldsby

Dr. Goldsby was important in the early development of synthetic detergents while at National Aniline. He was also active in the research leading to the sulfuric acid alkylation process at Texaco. He is the inventor or co-inventor of many of the important commercial features of this process. Dr. Goldsby will continue to work in this field while with Stratford Engineering Corp., as that firm has been appointed an agent for the sulfuric alkylation process.

Selas to Expand, Relocate

Selas Corp. of America, Philadelphia, will move its operations to an 11-acre site 22 miles out of Philadelphia, at Dresher, Pa., on the completion of a $1,000,000 plant at that location late this year. Three buildings are under construction, one for research and development, one for production facilities, and the third for administrative offices. The new location will almost double the firm's present 77,000-sq.-ft. manufacturing area and provide room for even further expansion.

Among the Selas products are microporous filters, membrane-type separators, heaters, and other process equipment.

P-E Enters Resonance Field

The Perkin-Elmer Corp. has gone into the manufacture of nuclear magnetic resonance equipment with the organization of a new subsidiary

known as Nuclear Magnetics Corp. The latter company has purchased the complete rights to the NUMAR line of resonance equipment from the Laboratory of Electronics, Inc., Boston, designers and manufacturers of electronic equipment.

Nuclear Magnetics will maintain executive offices and research and development facilities in Boston. Manufacturing will be carried on at the parent firm's plant in Norwalk, Conn.

Perkin-Elmer expects the new equipment to tie in directly with the infrared spectrophotometers and process stream analyzers the company now makes for laboratories and process plants.

Nuclear Magnetics lists the following persons as consultants: Prof. E. M. Purcell, Harvard University, Nobel Award winner for work toward the discovery of the resonance phenomena; Prof. Robert V. Pound, Harvard University; Prof. Francis Bitter, M.I.T., authority on electromagnets; Dr. Rex Richards, Oxford University. A. Carl Westbom, Jr. and Marvin C. Lewis, who worked with the NUMAR equipment at the Laboratory of Electronics, have joined the company as technical director and sales manager, respectively.

Personnel Changes

Crane Co.—Frank F. Elliott, senior vice-president of sales, to president and chief executive officer, succeeding John L. Holloway, who has resigned; George G. Lindholm, manager of the Chicago branch, to manager of the valve and fitting dept. at the general office in Chicago, succeeding F. J. Wilkey, who has been named special representative of the industrial sales div.; Thomas D. Kelly, manager of the Cleveland branch, to replace Mr. Lindholm as Chicago branch manager.

Davison Chemical Co.—Pierre F. Gunder, James A. Long, Jr., and William V. Brown to the research and development div.; Gunder and Brown have joined the research engineering dept. at the Curtis Bay plant, in Baltimore; Long is with the Baltimore office in the development dept.

Calumet & Hecla Inc.—Donald Q. Kern has been engaged as consultant in the field of heat transfer for the Wolverine Tube Div. Dr. Kern is author of a textbook on the topic used in engineering colleges.

Burgess-Manning Co.—H. A. Dietrich to manager of the Libertyville Div.; F. C. Duerr to manager of the Chicago district.

Pfaudler Co.—Charles M. Fletcher to manager of the Philadelphia regional office.

Cooper-Bessemer Corp. — George W. Edick to branch manager of compressor and stationary engine sales in New York City.

Pacific Pumps, Inc.—J. J. Coffey to manager of the newly opened Philadelphia district office.

Bell & Gossett Co.—Herman C. Zwart to petroleum pump sales manger of Marlow Pumps Div.

Beckman Instruments, Inc.—Dr. William S. Gallaway to newly established post of infrared applications supervisor of the Beckman Div.

Bailey Meter Co.—Paul S. Dickey, formerly vice-president and a director, to president, succeeding Robert S. Coffin, who was elected chairman of the executive committee and named management consultant; Harvard H. Gorrie, chief engineer, to vice-president in charge of all engineering activities.

Consolidated Engineering Corp.—Eugene J. Moscaret to manager of the Buffalo, N.Y., district sales and service center.

General Aniline & Film Corp.—Philip M. Dinkins to vice-president of operations of the dyestuff and chemical div.

International Nickel Co., Inc.—Leon M. Petryck to the development and research div. as a research metallurgist in the welding section at the Bayonne, N.J., laboratory.

Norton Co.—C. Herbert Quick to assistant to the director of research and development.

Fischer & Porter Co.—Robert A. Stern to vice-president of data reduction and automation div.; Louis H. Aricson to vice-president of the international div.; Nathaniel Brewer to vice-president of research; and Edward J. Querner to vice-president of manufacturing.

Foxboro Co.—H. O. Erishman to general sales manager and J. J. Burnett to field sales manager of the reorganized sales department; 10 regional sales offices have been set up with the following as sales managers: H. H. Michelmore, New England, E. R. Huckman, New York, J. B. Deaderick, Philadelphia, A. H. Shafer, Pittsburgh, E. W. Prendergast, Atlanta, H. L. Lee, Cleveland, J. J. Connelly, Chicago, E. L. Stark, Dallas, L. W. Parten, Houston, and R. E. Rogers, San Francisco.

Worthington Corp.—Hellmuth Walter to director of research; Robert S. Sherwood to asst. director of research.

Branches, Distributors

Graver Water Conditioning Co. has appointed Atlas-Misrock Co. sales representative in Virginia, Maryland and the southern part of Delaware. Atlas-Misrock is at 110 N. 8th St. in Richmond, Va.

Saran Lined Pipe Co., Ferndale, Mich., will be represented in Indiana, Kentucky and parts of Ohio and Illinois by Herbert D. Stuber, former superintendent of Dow Chemical Co.'s Saran rubber dept.

Naresco Equipment Corp., sales subsidiary of National Research Corp., has appointed the Hainge Co., Inc., sales representative in the Gulf Coast states. Hainge is at 3518 Durness, Houston.

ElectroData Corp. has named Data Processing Associates Ltd., Ottawa, sales and service representative in Canada.

Rhodia, Inc., has appointed Burhans-Sharpe Co. representative for its line of "Alamask" industrial reodorants in the Pacific Northwest. Burhans-Sharpe is at 1743 First Ave. S., Seattle.

Brown Fintube Co. has appointed the recently formed company of Benson, Funk, & Associates as sales and engineering representatives in the New England territory.

Expansion, Transition

Pfaudler Co. has changed its New York office to 33 Newark St., Hoboken, N. J., where it will continue to serve the same area; the southwest regional office has moved from Dallas to 514 W. Main St. in Houston.

Taylor Instrument Cos. has moved its western regional sales headquarters and branch assembly plant from San Francisco to San Leandro, Calif.

Inner valves are machined on duplicating lathes to exacting standards. In this photo, master contour plate on lathe at (A) automatically duplicates the exact contour desired at (B) to form the inner valve.

Precision parts on BS&B Controls are manufactured to close tolerances. This lathe operator "mikes" inner valve for a final tolerance of .001". Other parts require tolerances of as little as 3/10,000"

In Automatic Controls,

BS&B Means..."Trouble-Free"!

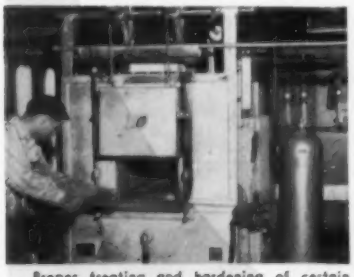
Ample production facilities and stocks of material assure prompt deliveries on all standard items in the BS&B Controls line.

Whenever you buy an automatic control, you look for the finest and most dependable one you can find for the job from the standpoint of quality, precision, long life and *"freedom from trouble."*

Freedom from trouble is especially important, because once a control is installed in the line, any "down-time" caused by its faulty operation becomes very expensive—usually many times more expensive than the entire cost of the control itself.

That's why it *always pays* to specify and buy BS&B Automatic Controls! Because of their superior quality and their long trouble-free performance, they'll *pay for themselves* in almost no time!

A Sinusoidal waveform apparatus is used to check the accuracy and performance of a BS&B Type 1440 Pressure Control Pilot.



Proper treating and hardening of certain component parts of BS&B Controls in one of these precisely controlled electric annealing furnaces is just one of the important manufacturing operations which assures their high quality and long trouble-free service.

Every BS&B Control must pass rigorous operating tests in our modern hydraulic testing and experimental laboratory. In this view, valves in the line are under test pressures from hydraulic pumps in the foreground. Operator checks readings on the control panel for valve performance.

EFFICIENCY
OVER 60 YEARS
BS&B
RELIABILITY

BLACK, SIVALLS & BRYSON, INC.

84 Sales Centers — Controls Division, Dept. 4-D7 — 40 Stocking Points

7500 East 12th Street, Kansas City 26, Missouri

(To obtain more data on advertised products see page 1056)

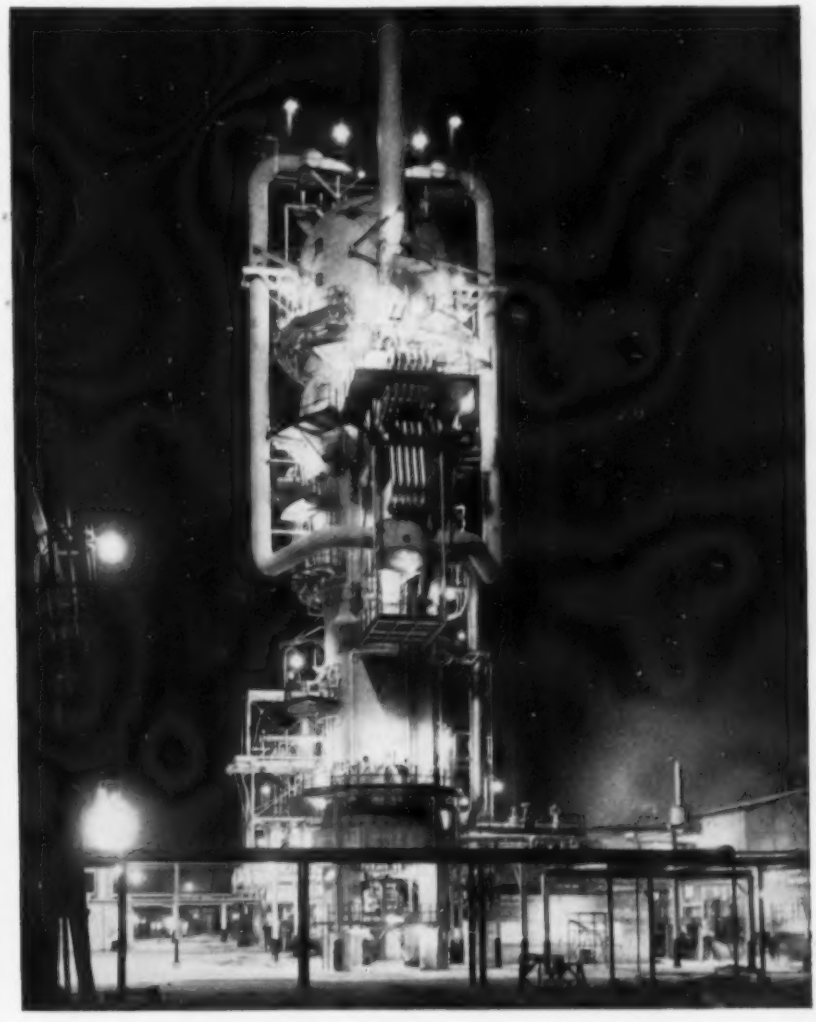
FIRST

IN CAT CRACKING

With over 30 per cent of all crude today eventually becoming cat cracker feed, cat cracker design is increasingly important to refiners. The superiority of the *Fluid* Cat Cracking design is well-established by the fact that 70 per cent of cat cracking capacity in the free world is the fluid design. The M. W. Kellogg Company has engineered or erected more than half of this fluid capacity.

M. W. Kellogg has been in the forefront of Fluid Catalytic Cracking from the beginning. Starting early with continuing studies of catalysts, it worked closely with the industry in engineering the fluid principle. M. W. Kellogg's contribution in mechanical engineering made it possible to design units of capacities large enough to meet accelerated demands for higher octanes since World War II. Its long experience in constructing oil refineries enabled M. W. Kellogg to undertake the erecting of these initial units, and the even larger ones in operation today, with full confidence that they would be on stream in minimum time.

An M. W. Kellogg Fluid Catalytic Cracking unit is your guarantee of many predetermined requirements, including throughput capacity, product quality and quantity, utility cost, catalyst loss, and coke-burning capacity. From its experience in engineering and erecting many side-by-side units, M. W. Kellogg originated



The distinctive vertical construction of M. W. Kellogg's Orthoflow Fluid Catalytic Cracker—a logical development from the side-by-side model—is becoming more and more familiar on refinery skylines. Orthoflow units completed or under construction since 1951 already represent a total throughput of over 290,000 BPD.

the straight-line Orthoflow* design—which offers many extra economic advantages.

A full-color, 13-minute movie, showing how the Orthoflow works, is now being booked for showings after July 1. Return coupon for particulars and to obtain a copy of our No. 2, 1955 Kelloggram which illustrates a recent Orthoflow installation.

Refinery Process Division

THE M. W. KELLOGG COMPANY

225 Broadway, New York 7, N. Y.

The Canadian Kellogg Company, Ltd., Toronto • Kellogg International Corp., London

SUBSIDIARIES OF PULLMAN INCORPORATED

**Trademark of The M. W. Kellogg Company*

Refinery Process Division
The M. W. Kellogg Company
225 Broadway, New York 7, N. Y.

☐ Send available dates for showing of your new Orthoflow film.

My preference after July 1 is (1) _____ *(2)* _____

☐ Send Kelloggram illustrating recent Orthoflow installation.

Name _____
(Title if any)

Company _____

Address _____

PP-7

 (To obtain more data on advertised products see page 1056)

When 10 to 1 is Commonplace

Barium-Based Additives will provide an Extra Measure of Protection

As compression ratios go up, H.D. lube oils will undoubtedly be made obsolete by V.H.D. grades . . . formulated with still better barium-based additives.

Anticipating additive-makers' needs, we have been improving our electric-furnace barium reduction process to produce a very dense, crystalline material with particle size adjusted to users' requirements. As a result, additive makers can now achieve desired control of reaction rates.

Westvaco also pioneered flake Barium Octahydrate and Barium Pentahydrate—advanced forms of soluble barium values now widely used. These pioneering efforts continue.

An advanced process developed by Westvaco engineers will soon bring you further benefits. Although we recently completed a 100% expansion of our facilities, we stand ready to again increase capacity should any eventuality require it.

When 10 to 1 is commonplace, better barium additives will be ready. As America's largest producer of barium chemicals, we shall continue to anticipate your needs.

If you are working with lube-oil additives, we would like you to have a copy of this new, 24-page booklet giving complete information on WESTVACO Barium Chemicals. Send for it now.

fmc Westvaco CHEMICALS

Westvaco Mineral Products Division
FOOD MACHINERY AND CHEMICAL CORPORATION
General Offices • 161 East 42nd Street, New York 17
CHICAGO, ILLINOIS • CINCINNATI, OHIO • HOUSTON, TEXAS • NEWARK, CALIFORNIA

(To obtain more data on advertised products see page 1056)

New Clinic at 10th ISA Conference

A CLINIC on computers has been added to the usual clinics on instrument maintenance and analytical instruments for the Instrument Society of America's 10th annual instrument-automation conference and exhibit. The event will take place at the Shrine Exposition Hall and Auditorium, Los Angeles, from Sept. 12 to 16.

The program of the conference itself will include discussion of testing instrumentation, production processes instrumentation, analysis instrumentation, and instrument maintenance and operation, among other topics. Details of the program will be presented in next month's issue of PETROLEUM PROCESSING.

The instruments maintenance clinic will be held on Sept. 10, 11 and 12 at the University of Southern California, which is in Los Angeles. This clinic was designed especially for operating, maintenance and apprentice personnel and is limited to 25 persons for each session. There will be eight two-hour sessions spread over the three days.

The clinic on analytical instruments will consist of six three-hour sessions, one given each morning and afternoon on Sept. 13, 14 and 15, at the Shrine Auditorium. Subjects of this clinic will include thermal-conductivity gas analyzers and gas chromotography (Gow-Mac Instrument Co.), negative type infrared analyzer (Leeds & Northrup Co.), positive type infrared analyzer (Liston-Becker Instrument Co.), water vapor recorder and thermal conductivity (Mine and Safety Appliances Co.), density and liquid level (Ohmart Corp.), infrared from laboratory to line (Perkins-Elmer Corp.), X-ray quantometer (Applied Research Labs), leak-detector, flow colorimeter, and special energy recorder (Beckman Instruments), and process refractometer (Consolidated Engineering Corp.).

The newest addition to the instrument conference, the computer clinic, will be held on Sept. 12, 13 and 14, as three-hour sessions each morning and afternoon. The course will cover the capabilities of various types of computer and how they may be used in process control, engineering calculations, data reduction, business data, processing, and other applications.

Subjects under discussion will be small, medium and large-size digital computers, direct analog computers, electronic differential analyzers, and mechanical analog computers.

Advance registration is required for all clinics and will cost ISA members $5 for each clinic, non-members $7.50. Because of the limited attendance at the clinics, the society urges interested persons to register early. Registration for any clinic carries admission to the technical sessions of the conference without additional fee. The exhibit is free. The ISA office is at 1319 Allegheny Ave., Pittsburgh 33, Pa.

Solar Energy Symposium Planned by New Group

Practical applications of solar energy will be discussed by scientists and industrialists Nov. 1 through 5 at a symposium planned by the Association of Applied Solar Energy. Formed in the spring of 1954 by some forty industrialists, bankers, agriculturists, and educators of the Southwest, the association has organized the symposium as its first activity. Other sponsors of the meeting are Stanford Research Institute and the University of Arizona. It will be given at the Westward Ho Hotel in Phoenix, Ariz.

At the outset of the meeting Dr. J. E. Hobson of Stanford Research Institute will introduce a discussion of "The Economics of Solar Energy." Another section of the program will deal with conversion techniques and will include these papers:

"Direct Conversion of Solar Energy," by Dr. Paul Erlandson, Southwest Research Institute; "Converting Solar to Chemical Energy," by Dr. L. J. Heidt, M.I.T.; and "Photovoltaic P-N Couples," by G. L. Pearson, Bell Telephone Laboratories.

Dr. Maria Telkes, New York University, will discuss "Solar Stills," and Dr. R. C. Jordan, University of Minnesota, will present material on "Mechanical Energy from Solar Energy."

AIEE to Offer Second Petroleum Conference

Taking their cue from the success of last year's meeting, The American Institute of Electrical Engineers will sponsor a second "Electrical Conference of the Petroleum Industry" from Sept. 12 to 14 at the Shamrock Hotel in Houston. Papers will be presented on electrical subjects in the refining, production, and pipeline segments of the petroleum industry, and there will be trips to nearby installations.

The conference will be organized by the petroleum industry committee and the Houston Section of the AIEE; chairman of the conference is H. M. Stewart, Humble Oil and Refining Co., Baytown. Vice-chairman is H. J. Kongabel, Westinghouse Electric Corp., Houston. J. Z. Linsenmeyer, of Westinghouse in Pittsburgh, is chairman of the petroleum industry committee. Advance registration forms and programs may be obtained from J. C. Gardner, Westinghouse Electric Corp., 507 Dallas Ave., Houston 2.

Oil Man's Calendar

JULY

2nd Western Plant Maintenance and Engineering Show, Pan Pacific Auditorium, Los Angeles, July 12-14.

AUGUST

Society of Automotive Engineers, golden anniversary West Coast meeting, Hotel Multnomah, Portland, Oregon, August 15-17.

SEPTEMBER

Petroleum Industry Conference, sponsored by the American Institute of Electrical Engineers, Houston, Sept. 12-14.

Instrument Society of America, 10th national instrument conference and exhibit, Los Angeles, Sept. 12-16.

National Petroleum Assn., annual meeting, Traymore Hotel, Atlantic City, Sept. 14-16.

Western Petroleum Refiners Assn., regional technical-industrial relations meeting, Casper, Wyo., Sept. 22-23.

American Institute of Chemical Engineers, Lake Placid Club, Lake Placid, N.Y., Sept. 25-28.

OCTOBER

American Society of Mechanical Engineers, petroleum branch, fall meeting, Roosevelt Hotel, New Orleans, Oct. 2-5.

American Society for Testing Materials, Committee D-2, petroleum products and lubricants, Statler Hotel, Washington, D.C., Oct. 2-6.

American Oil Chemists' Society, fall meeting, Hotel Bellevue Stratford, Philadelphia, Oct. 10-12.

California Natural Gasoline Assn., fall meeting, Ambassador Hotel, Los Angeles, Oct. 13-14.

American Gas Assn., annual convention, Los Angeles, Oct. 17-19.

First Congress on Petroleum, sponsored by the University of Oriente, Santiago de Cuba, Oct. 21-23.

National Lubricating Grease Institute, annual meeting, Edgewater Beach Hotel, Chicago, Oct. 31-Nov. 2.

NOVEMBER

Society of Automotive Engineers, golden anniversary diesel engine meeting, The Chase, St. Louis, Nov. 2-4.

Society of Automotive Engineers, golden anniversary fuels and lubrication meeting, Hotel Bellevue Stratford, Philadelphia, Nov. 9-10.

2nd International Automation Exposition, Navy Pier, Chicago, Nov. 14-17.

American Petroleum Institute, annual meeting, Mark Hopkins, Fairmont, St. Francis, and Palace Hotels, San Francisco, Nov. 14-17.

American Institute of Chemical Engineers, annual meeting, Statler Hotel, Detroit, Nov. 27-30.

No fitting is too good for me because I have to stand beside them!

THAT'S WHY I USE

Swagelok®

TUBE FITTINGS

"Just one pinhole leak or one fitting 'letting go' could mean disaster for me, equipment and property. That's why I use the best—Swagelok Tube Fittings. They are built for rugged service and unusual operating conditions."

Swagelok Tube Fittings because of their unique design provide strong, torque-free, leakproof seals in all tubing connections. Two ferrules and the threaded chuck grasp the tube tightly. No special tools are needed for assembly or disassembly and no preparatory work on the tubing is required.

For complete information write for the Swagelok catalog. Address Dept. D2.

Swagelok Tube Fittings Available in: Brass, Aluminum, Steel, Stainless Steel, Monel, Zytel*

*DuPont trade-mark

CRAWFORD FITTING CO.

884 E. 140th Street

Cleveland 10, Ohio

Information Offered in the Advertisements

Do you need detailed information on a specific subject? Check through this easy-to-use index of literature and data being offered in this issue's advertisements.

ACTIVATED ALUMINA, for drying, brochure; Reynolds Chemicals. See adv't. p. 1071.

ADDITIVES, grease, booklet describes properties; DuPont de Nemours & Co. See adv't. pp. 968A-968B.

ADDITIVES, lube oil, barium based, booklet; Westvaco Mineral Products Div. See adv't. p. 1052.

BUBBLE CAPS, 300 styles, bulletin 22; Pressed Steel Co. See adv't. p. 1078.

BULK STORAGE, booklet describes services; Hess Terminal Corp. See adv't. p. 1070.

CATALYTIC CRACKING units, fluid, movie and diagram; M. W. Kellogg Co. See adv't. pp. 1050-1051.

COMBUSTION UNITS, tandem, vertical and horizontal, bulletin 498; National Airoil Burner Co. See adv't. p. 1072.

COMPRESSORS, gas, complete catalog; Cooper-Bessemer Corp. See adv't. p. 1042.

CONDUIT, aluminum, rigid, factbook; Alcoa Aluminum. See adv't. p. 1064.

COOLING UNITS, air and air and water, new bulletin; Hudson Engineering Corp. See adv't. cover 2.

EXPANSION JOINTS, bulletin 351; Zallea Brothers. See adv't. p. 964.

FLOATING ROOFS, double pontoon, manual WP-14; Gen'l. American Trans. Corp. See adv't. p. 952.

FLOW TRANSMITTER, new type, bulletin 13-11; Foxboro Co. See adv't. pp. 972-973.

HEAT EXCHANGERS, bulletin 521; Brown Fintube Co. See adv't. p. 1065.

INSULATION, block and molded pipe types, catalog; Owens-Corning Fiberglas Corp. See adv't. p. 1073.

MECHANICAL SEALS, "Teflon," bulletin MS-954; U. S. Gasket Co. See adv't. p. 1062.

MIXING AND BLENDING equipment, 8 catalogs and data sheets; Mixing Equipment Co. See adv't. p. 984.

PRESSURE TRANSMITTER, bulletin 98097; Taylor Instrument Co. See adv't. pp. 978-979.

RADIOISOTOPE REAGENTS, special catalog available; Baker & Adamson, Gen'l. Chemical Div. See adv't. cover 3.

REFINERY CONSTRUCTION, brochure 103 describes recent construction; Kaiser Engineers. See. adv't. p. 1029.

REFINERY ENGINEERING, bulletin FC 8.001R describes research facilities; Fluor Corp. See. adv't. p. 1044.

REFRACTORY LININGS, hydraulic setting, brochure 28A; Johns-Manville. See adv't. p. 1041.

STEAM TRAPS, stainless steel, trap selector; Yarnall-Waring Co. See adv't. p. 1079.

TUBE FITTINGS, "Swagelok," available in many materials, catalog; Crawford Fitting Co. See adv't. p. 1054.

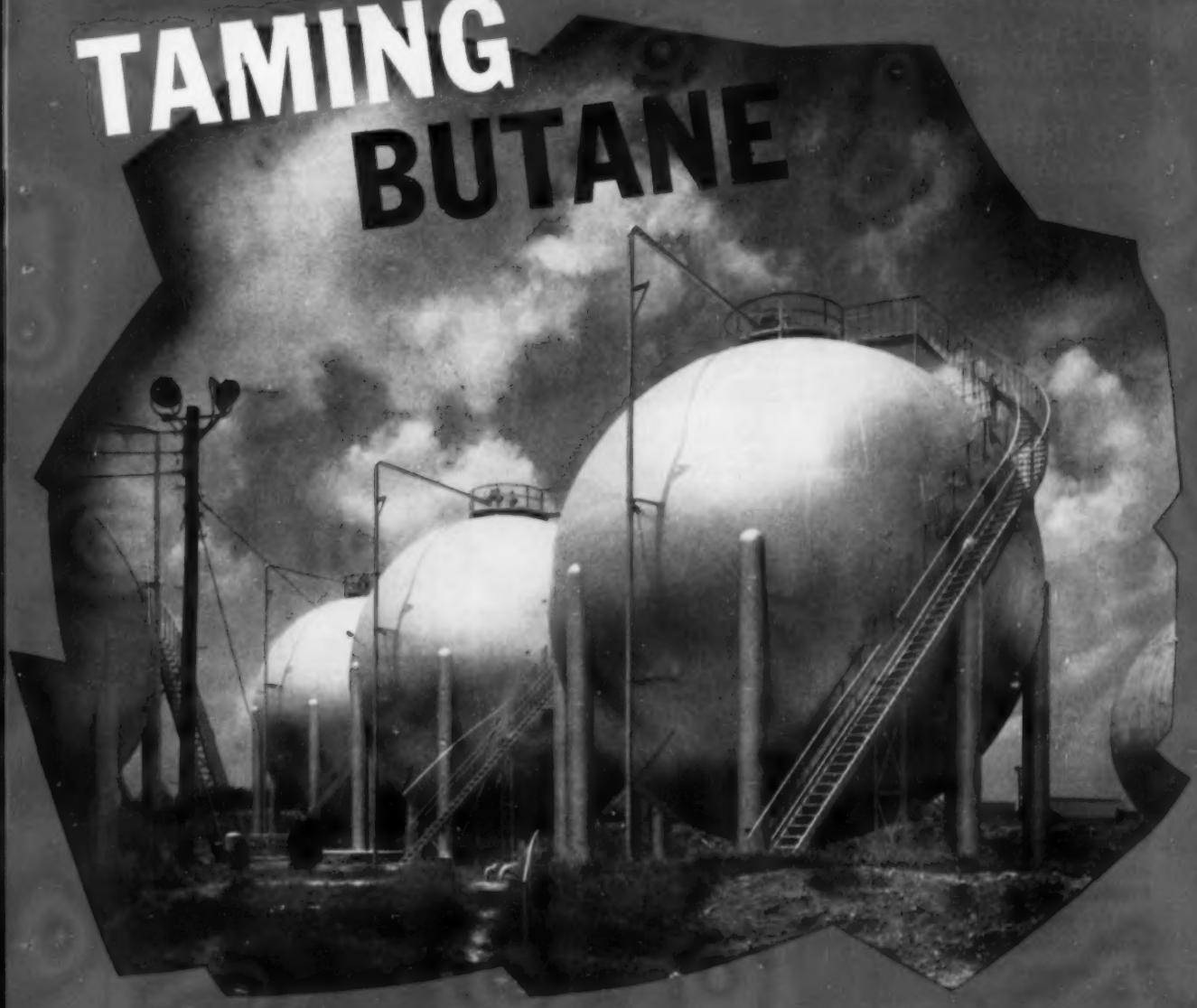
TUBES, heat exchanger, aluminum, booklet; Alcoa Aluminum. See adv't. p. 983.

TUBING, condenser, finned, booklet and catalog; Wolverine Tube. See adv't. pp. 1040A-1040B.

VALVES, gate, jacketed, catalog J-50; Hetherington & Berner, Inc. See adv't. p. 1078.

VALVES, lubricated plug, reference book 39-5; Homestead Valve Mfg. Co. See adv't. p. 1030.

TAMING BUTANE



Three 10,000-bbl. Hortonspheres designed for a working pressure of 80 lbs. per sq. in. They are used to store butane for the Warren Petroleum Corporation, Houston, Texas.

Butane is stored under pressure to prevent it from disappearing into the atmosphere. Hortonspheres®, designed to withstand internal pressure, will tame this exceedingly volatile hydrocarbon. No vapor can escape as long as the internal pressure does not exceed the setting of the pressure relief valves.

Hortonspheres are built in standard capacities to 30,000 bbls. and for pressures up to 217 lbs. per sq. in. in the smaller sizes. Write our nearest office for further information.

CBI

Chicago Bridge & Iron Company

Atlanta • Birmingham • Boston • Chicago • Cleveland • Detroit • Houston
Los Angeles • New York • Philadelphia • Pittsburgh • Salt Lake City
San Francisco • Seattle • Tulsa
Plants in BIRMINGHAM, CHICAGO, SALT LAKE CITY and GREENVILLE, PA.

ADVERTISERS' INDEX

This index is published as a convenience to the reader. Every care is taken to make it accurate, but PETROLEUM PROCESSING assumes no responsibility for errors or omissions.

FOR INFORMATION ON ANY PRODUCT OR SERVICE ADVERTISED IN THIS ISSUE SEE INSTRUCTIONS BELOW

Each advertiser listed in this index has been assigned a code letter for use by the reader in securing additional information about advertised products, or services which interest him. This code letter appears in parentheses following the advertiser's name.

•

Circle the code letter on the "Advertised Product Inquiry" card (on the page opposite) which corresponds to that assigned the advertiser about whose product you want further information.

Fill in your name, title, company and mailing address and mail the card . . . no postage is required.

The Petroleum Processing Reader Service Department will give your inquiries prompt and efficient handling.

A

Airetool Mfg. Co. (I-2) 1080
Air Preheater Corp. (D-6) 1032
Alamask Div., Rhodia, Inc. (H-4) 1074
Aluminum Co. of America, Chemical Div. (A-8) 961
Aluminum Co. of America, Electrical Div. (G-3) 1064
Aluminum Co. of America, Process Equip. Div. (C-5) 983
American Cyanamid Co., Refinery Chemicals Dept. (B-5) 970-971
Anaconda Copper Mining Co. (I-7) 1085
Anthracite Equipment Corp. (E-2) 1036

B

Baker & Adamson, Gen'l. Chemical Div. (I-8) ..... Cover 3
Baker & Co., Inc. (C-8) 1026
Barrett Mfg. Co. (D-4) 1030
Black, Sivalls & Bryson, Inc. (F-4) 1049
Brown Fintube Co. (G-4) 1065

C

Chicago Bridge & Iron Co. (F-8) 1055
Cities Service Co. (B-1) 1010
Condenser Service & Engr. Co. (D-7) 1034
Cooper-Bessemer Corp. (E-8) 1042
Crane Co. (C-7) 1008
Crawford Fitting Co. (F-7) 1054

D

Dowell, Inc. (G-6) 1066
DuPont de Nemours & Co., Petroleum Chemicals Div. (B-3) 968A-968B
DuPont de Nemours & Co., Petroleum Chemicals Div. (E-4) 1038

E

Enjay Co. (C-9) 949
Ethyl Corp. 1006-1007

F

Fluor Corp. (E-9) 1044
Foster Wheeler Corp. (A-9) 962-963
Foxboro Co. (B-6) 972-973

G

Gen'l. American Trans. Corp., Plate & Welding Div. (A-4) 952
Gen'l. American Trans. Corp., Terminals Div. (A-5) 954
General Refractories Co. (D-5) 1031
Glitsch & Sons, Inc., F. W. (H-6) 1076
Graver Tank & Mfg. Co. (A-7) 958
Greiner Co., Emil (F-2) 1045

H

Harshaw Chemical Co. (F-3) 1046
Hercules Powder Co. (B-2) 968
Hess Terminal Corp. (G-9) 1070
Hetherington & Berner, Inc. (H-8) 1078
Homestead Valve Mfg. Co. (D-3) 1030
Houdry Process Corp. (C-4) 982
Hudson Engineering Corp. (A-1) ..... Cover 2

I

International Nickel Co. (B-8) 976

J

Johns-Manville Corp. (G-5) 1041

K

Kaiser Engineers (D-2) 1029
Kellogg Co., M. W. (F-5) 1050-1051

L

Lukens Steel Co. (G-8) 1069
Lummus Co. (A-6) 957

M

McKee Co., Arthur G. (G-2) 1063
Midwest Piping Co. (F-9) 1059
Mixing Equipment Co. (C-6) 984

N

National Airoil Burner Co. (H-2) 1072
National Aluminate Corp. (I-5) 1083
Newport News Shipbuilding & Drydock Co. (I-3) 1081
Norton Co. (C-1) 977

O

Oakite Products, Inc. (G-7) 1068
Ohio Apex Div. (F-1) 1045
Oronite Chemical Co. (E-7) 1067
Owens-Corning Fiberglas Corp. (H-3) 1073

P

Phoenix Mfg. Co. (E-1) 1036
Powell Co., William (H-4) 1075
Pressed Steel Co. (H-9) 1078
Procon, Inc. (H-7) 1077
Proportioneers, Inc. Div. of B-I-F Ind. (A-3) 950

R

Refinery Engineering Co. (B-4) 969
Reynolds Metals Co. (H-1) 1071
Ridge Tool Co. (I-4) 1082
Rockwell-Nordstrom Valves (B-9) 976A-976B

S

St. Mary Iron Works (E-5) 1040
Sauereisen Cements Co. (D-8 1034
Shell Development Co. (D-9) 1035
Smith Corp., A. O. (C-3) 980-981

T

Taylor Instrument Cos. (C-2) 978-979
Tennessee Corp. (D-1) 1028

U

U. S. Gasket Co. (G-1) 1062
Universal Oil Products Co. (B-7) 974-975

V

Vogt Machine Co., Henry (I-6) 1084

W

Warren Petroleum Corp. (E-3) 1037
Westvaco Mineral Products (F-6) 1052
Wolverine Tube, Div. Calumet & Hecla, Inc. (E-6) 1040A-1040B
Wyatt Metal & Boiler Works (I-9) Cover 4

Y

Yarnall-Waring Co. (I-1) 1079

Z

Zallea Brothers (A-2) 964

CLASSIFIED ADVERTISING

F. J. Eberle, Ass't. Mgr.

EMPLOYMENT OPPORTUNITIES 1043

EQUIPMENT (Used or Surplus New) For Sale 1043

SAVE TIME • SAVE EFFORT • KEEP INFORMED

USE THIS CARD . . .

to secure information on products and services advertised in *Petroleum Processing* or reviewed in its *"What's New"* section.

FOR ADVERTISED PRODUCT INFORMATION:
Check the Advertiser's Index for advertisement's code letter. Then circle the corresponding code letter on the card below.

FOR "WHAT'S NEW" PRODUCT INFORMATION:
Circle the code number on the card below which corresponds to the number listed at the end of that specific "What's New" item.

THEN:
Fill in your name, position, company and mailing address. Mail the card . . . no postage is required.

PETROLEUM PROCESSING READER SERVICE INFORMATION CARD—VOID AFTER OCTOBER 15, 1955

"WHAT'S NEW" ITEMS

1	2	3	4	5	6	7	8
9	10	11	12	13	14	15	16
17	18	19	20	21	22	23	24
25	26	27	28	29	30	31	32
33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48
49	50	51	52	53	54	55	56
57	58	59	60	61	62	63	64
65	66	67	68	69	70	71	72
73	74	75	76	77	78	79	80

ADVERTISED PRODUCTS

A1	B1	C1	D1	E1	F1	G1	H1	I1	J1	K1	L1	M1	N1	O1	P1
A2	B2	C2	D2	E2	F2	G2	H2	I2	J2	K2	L2	M2	N2	O2	P2
A3	B3	C3	D3	E3	F3	G3	H3	I3	J3	K3	L3	M3	N3	O3	P3
A4	B4	C4	D4	E4	F4	G4	H4	I4	J4	K4	L4	M4	N4	O4	P4
A5	B5	C5	D5	E5	F5	G5	H5	I5	J5	K5	L5	M5	N5	O5	P5
A6	B6	C6	D6	E6	F6	G6	H6	I6	J6	K6	L6	M6	N6	O6	P6
A7	B7	C7	D7	E7	F7	G7	H7	I7	J7	K7	L7	M7	N7	O7	P7
A8	B8	C8	D8	E8	F8	G8	H8	I8	J8	K8	L8	M8	N8	O8	P8
A9	B9	C9	D9	E9	F9	G9	H9	I9	J9	K9	L9	M9	N9	O9	P9

PETROLEUM PROCESSING
A McGRAW-HILL PUBLICATION

7/55

Name (Please Print) _____ Position _____

Company _____ Business Address _____

City, Zone _____ State _____

PETROLEUM PROCESSING READER SERVICE INFORMATION CARD—VOID AFTER OCTOBER 15, 1955

"WHAT'S NEW" ITEMS

1	2	3	4	5	6	7	8
9	10	11	12	13	14	15	16
17	18	19	20	21	22	23	24
25	26	27	28	29	30	31	32
33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48
49	50	51	52	53	54	55	56
57	58	59	60	61	62	63	64
65	66	67	68	69	70	71	72
73	74	75	76	77	78	79	80

ADVERTISED PRODUCTS

A1	B1	C1	D1	E1	F1	G1	H1	I1	J1	K1	L1	M1	N1	O1	P1
A2	B2	C2	D2	E2	F2	G2	H2	I2	J2	K2	L2	M2	N2	O2	P2
A3	B3	C3	D3	E3	F3	G3	H3	I3	J3	K3	L3	M3	N3	O3	P3
A4	B4	C4	D4	E4	F4	G4	H4	I4	J4	K4	L4	M4	N4	O4	P4
A5	B5	C5	D5	E5	F5	G5	H5	I5	J5	K5	L5	M5	N5	O5	P5
A6	B6	C6	D6	E6	F6	G6	H6	I6	J6	K6	L6	M6	N6	O6	P6
A7	B7	C7	D7	E7	F7	G7	H7	I7	J7	K7	L7	M7	N7	O7	P7
A8	B8	C8	D8	E8	F8	G8	H8	I8	J8	K8	L8	M8	N8	O8	P8
A9	B9	C9	D9	E9	F9	G9	H9	I9	J9	K9	L9	M9	N9	O9	P9

PETROLEUM PROCESSING
A McGRAW-HILL PUBLICATION

7/55

Name (Please Print) _____ Position _____

Company _____ Business Address _____

City, Zone _____ State _____

FOR MORE INFORMATION...

about products and services advertised in this issue of Petroleum Processing or reviewed in its "What's New" section, use the postage-free cards provided below.
(See other side for complete instructions.)

FIRST CLASS
PERMIT NO. 64
(Sec. 34.9 P. L. & R.)
New York, N. Y.

BUSINESS REPLY CARD
No Postage Necessary if Mailed in the United States

4c-POSTAGE WILL BE PAID BY

PETROLEUM PROCESSING

330 WEST 42nd STREET

NEW YORK 36, N. Y.

FIRST CLASS
PERMIT NO. 64
(Sec. 34.9 P. L. & R.)
New York, N. Y.

BUSINESS REPLY CARD
No Postage Necessary if Mailed in the United States

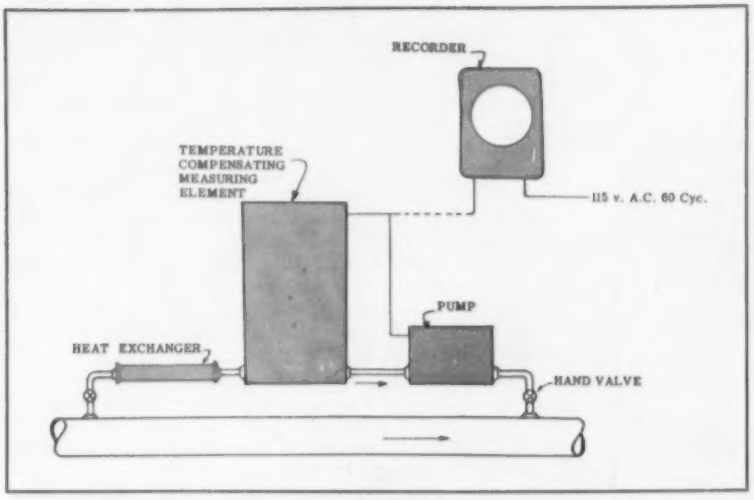
4c-POSTAGE WILL BE PAID BY

PETROLEUM PROCESSING

330 WEST 42nd STREET

NEW YORK 36, N. Y.

WHAT'S NEW...



Viscometer Records and Controls

Designed for petroleum applications providing a continuous record of viscosity, the viscometer is applicable also for automatic control. A side stream is established to flow a small sample to the temperature-compensated measuring element for viscosity determination. A heat exchanger can be used when necessary to bring the temperature of the sample within the compensating range and a small proportioning pump is used to return the sample in the line. All of the electrical components comply with Underwriters' requirements for Class 1 Group D locations.

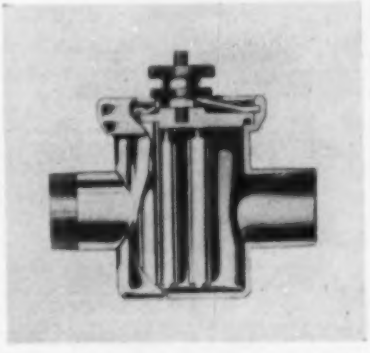
A remotely located recorder furnishes a record on a 24-hour circular chart, and for automatic control the recorder provides 3-15 lbs. air pressure for use in conjunction with standard pneumatic controllers.

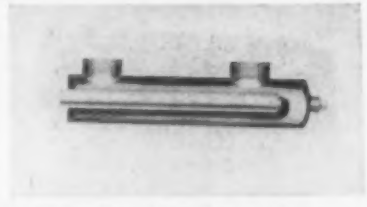
The operating principle provides high sensitivity and accuracy with ruggedness of construction. Norcross Corp., Dept. No. N33, Newton 58, Mass.

Circle No. **1** *on Reply Card*

For More Information

Use one of the attached reply cards to request additional details or literature on any items reviewed in "What's New!" Just circle the numbers corresponding to the numbers at the end of each item in which you are interested. Then fill in the rest of the card and drop it in the mail. No postage is required.

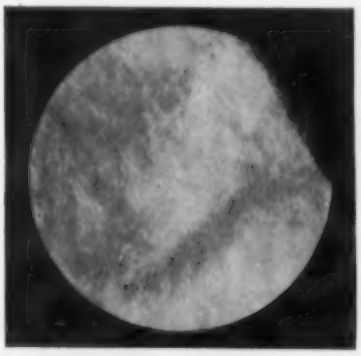




Magnetic Pipeline Trap

. . . removes iron fines and tramp iron from practically any kind of liquid material passing through pipelines. The "Ferrotrap" is self-contained, and depends upon an Alnico V magnet for operation. The only maintenance required is the periodic removal of iron accumulations. Model B is made of 316 stainless steel and is available for 2, 3, or 4-in. pipelines. Multiple magnetic elements contained in stainless steel tubes are so positioned within the trap so that material is caused to flow in thin streams and in variously changed directions over the whole length of the magnets to insure trapping very fine iron particles. Pressure drop through the trap is small, and operation can be at pressures up to 150 psig. Model L is for less exacting requirements, primarily tramp iron separation in line from ½-in. to 2-in., and is made of bronze for operation up to 150 psig. Eriez Mfg. Co., Erie 6, Pa.

Circle No. **2** *on Reply Card*

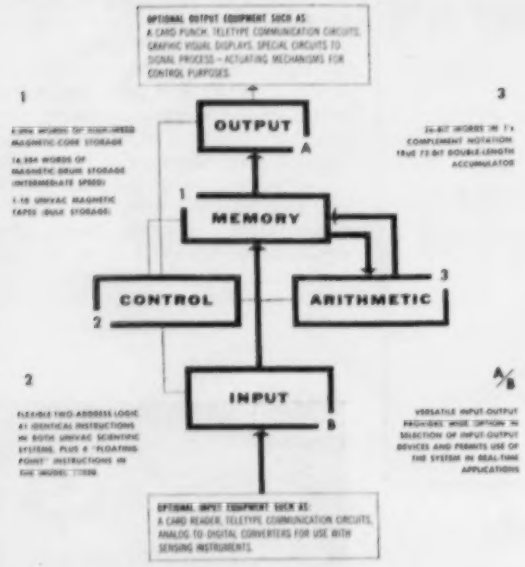


Synthetic Filter Felt

. . . is made of Dynel fibers, tightly compacted. Principal applications are for pressure filters and centrifuges contacting concentrated mineral acids and bases as well as a variety of organic acids, bases and salts. The "FEON Dynel" felt is easy to clean and in operation retains fine solids, yet has a relatively high porosity permitting high filtering rates. In its manufacture, short fibers of Dynel are carded in both directions for strength, dimensional stability and smoothness. The fibers are treated with a resin binder. After felting, the bond is "set" under heat and pressure to give the finished filter cloth. The bonding agent is Vinyon, the same basic material as Dynel, and will withstand any chemicals for which Dynel itself is suitable. Dynel felts have greater chemical resistance than wool felts, do not shrink, and keep their shape making it easier to fit into the filter presses. Maximum temperature is 170°F., and bursting strengths are from 200 to 350 psi. Filtration Fabrics Div., Filtration Engineers Inc., 155 Oraton St., Newark 4, N. J.

Circle No. **3** *on Reply Card*

Electronic Computer for Scientific Work



Two new "Univac-Scientific" models—with developments making the computer compatible with the Univac and the File-Computer—have been announced. Originally designed and built for the U.S. Government for use in the guided missile program at the White Sands Proving Grounds, the computer is adaptable to the control of industrial and scientific processes.

The new development making the Univac-Scientific compatible with other of the company's computers is the use of metal magnetic tape on all computers. Previously the Univac-Scientific used plastic tape which could not be used with other models.

Another development is that the Univac-Scientific can now utilize the auxiliary equipment developed for the commercial Univac, such as the High-Speed Printer which prints results of computations and data reduction at a speed of 600 lines per minute in any desired format.

Both new models are virtually identical in scope. Data can be read out of the magnetic memory of the system in micro-seconds, and the computer section requires about one second for mathematical operations which would require an hour at best by other means.

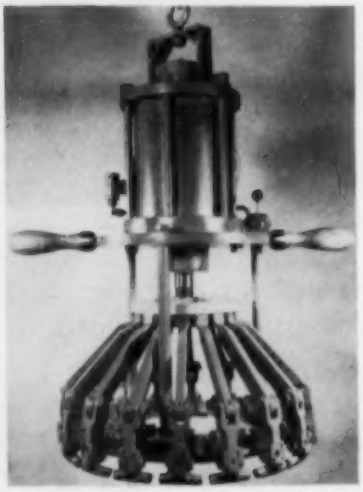
General storage for the new models has been increased from 17,408 registers to 20,480 by the replacement of electrostatic registers by magnetic core storage. Remington Rand Inc., 315 Fourth Ave., New York 10, N.Y.

Circle No. **4** *on Reply Card*

Midget Pressure Filter

. . . **is for laboratory** and field applications. In filtration research and for the determination of filtration characteristics needed for production filter selection, "Pronto-Junior" permits the use of one, two or three vertical filter leaves. The filter can be set up in the plant to filter liquids as they are processed, or can be located in the laboratory. A net filtering area of one sq. ft. is provided when using three filter leaves spaced at 1½-in. intervals. The leaves are covered with 24x110 Dutch weave metal cloth, bound in U-shaped leaf frames. Outlet nozzles are sealed by "O" rings. Cake erosion is prevented by having the inlet ports facing away from the leaf surfaces. Constructed of stainless steel with Type 316 stainless on all liquid contact parts, it is suitable for a maximum working pressure of 80 psi. The filter overall height is about 16 in. and the shell diameter about 6½ in. American Plant Equipment Co., Mfg. Div., 701 Spring St., Elizabeth 4, N. J.

Circle No. **5** *on Reply Card*



New Drum Cover Crimper

. . . **is portable and compact** for use in tight spaces. The "Model PMC-3U" is designed for sealing the universal standard 120# lug cover drum. It is an overhead suspended crimping head, directly connected with a 6-in. double-acting air cylinder, complete with valves and handles. Weighing about 180 lbs., it can be installed with either a counterbalance rig or a balancing unit. The operator places the drum roughly below the unit, then manually positions the crimpet on the drum for the crimping operation. Operation completed, the counterweight raises the unit so that the drum will clear. Barrett Mfg. Co., Houston, Texas.

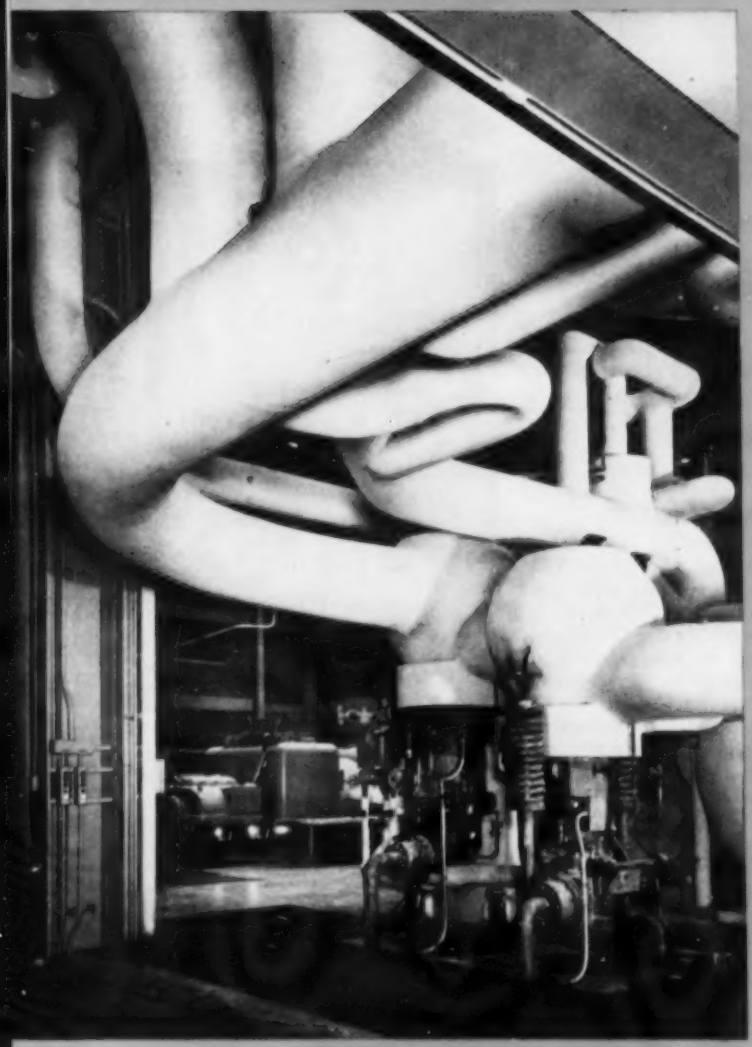
Circle No. **6** *on Reply Card*

New Plastic Fire Hose

. . . **is made of Dacron**—neoprene impregnated—to meet requirements of the oil industry and chemical plants where oil, chemicals, rough use and mildew demand a long-wearing hose. The hose tube is of oil resistant neoprene covered by strands of 100% Dacron yarn, which is in turn impregnated with neoprene. Test pressure for this hose on delivery is 500 lbs. per 50-ft. length. It is available in two sizes; 1½-in. and 2½-in. diameters. Fyr-Fyter Co., 221 Crane St., Dayton 1, Ohio.

Circle No. **7** *on Reply Card*

What do you buy when you place a *Piping Contract?*



What you really buy is performance . . . and good value for your piping dollar. And how do you get these? By selecting a piping contractor who has a reputation for quality work . . . who is called upon to do job-after-job for the same customers. It's as simple as that.

Midwest is such a piping contractor. Midwest Piping is superior piping and good value for every piping dollar. We shall be happy to have you ask us to prove it.

PIPING FABRICATORS AND CONTRACTORS FOR MORE THAN *50 Years*

MIDWEST PIPING COMPANY, INC.

Main Office, 1450 South Second St., St. Louis 4, Mo.

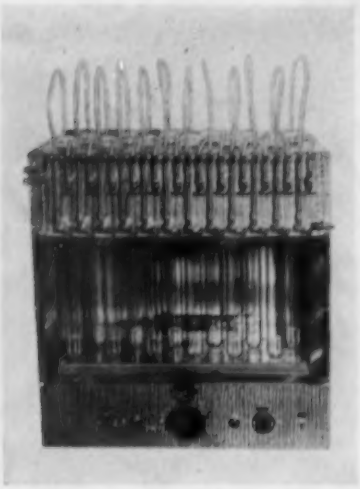
PLANTS: ST. LOUIS, PASSAIC, LOS ANGELES, and BOSTON

SALES OFFICES: NEW YORK 7—50 CHURCH ST. • BOSTON 27—425 FIRST ST. LOS ANGELES 33—520 ANDERSON ST. • CHICAGO 3—79 WEST MONROE ST. TULSA 3—224 WRIGHT BLDG. • HOUSTON 2—1213 CAPITOL AVE. CLEVELAND 14—616 ST. CLAIR AVE.

6492

MIDWEST **PIPING FABRICATION and CONSTRUCTION**

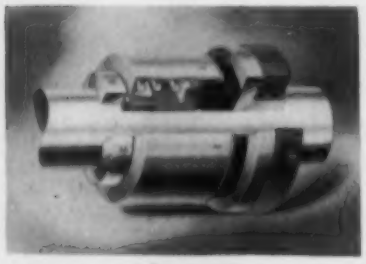
OFFERS YOU MANY BENEFITS



Oxidation Inhibitor Bath

. . . analyzes turbine oil inhibitor life. To test an oil sample, the bath uses water, oxygen and an iron-copper catalyst, and subjects the sample to 95°C. ± 0.2°C. Twelve oxidation cells are accomodated in the bath, which is made of corrosion resistant stainless steel. Flow measurement is by "flow-rater" type made of pyrex glass with stainless steel floats. Individual needle flow control valves assure a flow rate of three liters of oxygen per hour to each sample. A tempered glass window and two fluorescent lamps permit the operator to determine sample levels without removing the cells. The bath has 115 v., 60 cycle, single phase a-c operation with other voltages and frequencies available. Size is 30-in. long, 18-in. wide, and 32-in. high. The Emil Greiner Co., 20-26 N. Moore St., New York 13, N. Y.

Circle No. **8** *on Reply Card*



Mechanical Seal

. . . designed for rotary shafts at pressures up to 150 psi and called the "BB-21A Mechanipak Seal" is furnished completely assembled, ready to install. Standard construction includes brass shell, brass washer, and Buna-N bellows. Seals are available for shafts from ⅜-in. to 3-in. diameters. Buna-N or neoprene bellows are furnished for temperatures up to 212°F. and pressures up to 150 psi. Silicone bellows are provided for temperatures up to 400°F. where pressures do not exceed 50 psi. The Garlock Packing Co., Palmyra, N. Y.

Circle No. **9** *on Reply Card*

Stainless Heat Exchangers

. . . designed for corrosive liquids in heating or cooling services have applications in the chemical, refining, etc. industries. The type "SSF" heat exchangers are of fixed tube bundle construction and available in single and multi-pass models in a large range of sizes and capacities. The exchanger design eliminates expansion strains due to radical temperature difference. Smooth flow end bonnets minimize impact on tubes and tube sheets at the inlet to the tube bundle. Tubes are rolled into sheets by a special electronically controlled process for efficient joints. Other features include 20% segmented baffles spaced for maximum heat transfer and minimum pressure drop. Heat resistant gasket eliminates by-passing and prevents leakage. Young Radiator Co., Racine, Wisc.

Circle No. **10** *on Reply Card*

Plastic Bubble-Caps

. . . are corrosion-resistant to all solvents, alkalis and acids except hypochlorite, chromic acid, nitric acid or sulphuric acid over 70% concentration. The bubble-caps—and risers—called "Camac Furacam" are precision cast of glass reinforced furfural ketone resin with carbon loading. The caps are rugged and will withstand temperatures to 350°F. The assembly can be secured to a tray with Teflon snap rings, or Neoprene "O" rings. Design allows full gas flow with a minimum of resistance. Trays can be operated with a liquid level from 1-in. to 1½-in. Carl Buck & Assocs., Essex Fells, N. J.

Circle No. **11** *on Reply Card*

Multi-Component Analyzer

. . . is for gases or liquids and is based on the principle of gas chromatography, utilizing the fractional separation of vapors by means of a partition column. Time for analysis varies from ½ to 5 minutes per component. Reproducibility is better than ½%. Any mixture having boiling points up to 250°C. may be analyzed. As little as one milligram of sample per analysis is needed. The "Vapor Fractometer" consists of two interchangeable four-foot folded partition columns which may be used individually or in tandem, a special thermister-type thermoconductivity cell as a detector, and sampling and temperature controls. The partition columns are mounted in an insulated chamber which may be held at any temperature between room and 150°C. The apparatus weighs less than 50 lb. and measures 30x20x12 in. Detector output may be connected directly to any standard 10 millivolt recorder. Any convenient carrier gas may be used, though helium is recommended. The Perkin-Elmer Corp., Norwalk, Conn.

Circle No. **12** *on Reply Card*

Are YOU Looking for a BETTER Job?

Petroleum Processing is again expanding its editorial staff, and its editors are looking for a man with technical training to fill the opening of assistant editor.

The job offers the man we select an interesting opportunity in an exciting field of activity. He will have the chance to get better acquainted with the broader aspects of the petroleum processing industry, to meet and talk with its top-notch technical people, to be "in the know" about new developments in the industry even before they are announced. He will be affiliated with a dynamic, fast-moving publication, backed by the largest and most progressive business magazine publishing firm in the world.

Here are the specifications:

Education: If you are the man we want, you're a graduate engineer, with a B.S. in mechanical engineering. You were in the top third of your class scholastically.

Industry Experience: You have had some practical experience (although maybe only a few years) in our industry. You are now employed by an engineering firm, or in the engineering department of a petroleum or chemical company, and associated in some technical capacity with petroleum refining, petrochemical manufacturing, or natural gasoline recovery. You know the kind of engineers who read Petroleum Processing, and the kind of problems they are up against.

Writing Experience: You have probably never thought of editorial work as a career, but you've probably been writing reports in connection with your work and found satisfaction in putting information down on paper in a clear, logical organized manner. You may have done some writing as a hobby, or even have worked on a high school, college or similar paper or magazine. You can express yourself well.

Personality: You are curious about "why" and "how" things work, and you have the ability to explain their workings to others. You are able to organize your own work, and you have initiative to push ahead and get things done. You like meeting people and talking with them, yet at the same time you are a good listener, but you are not a "glad-hander."

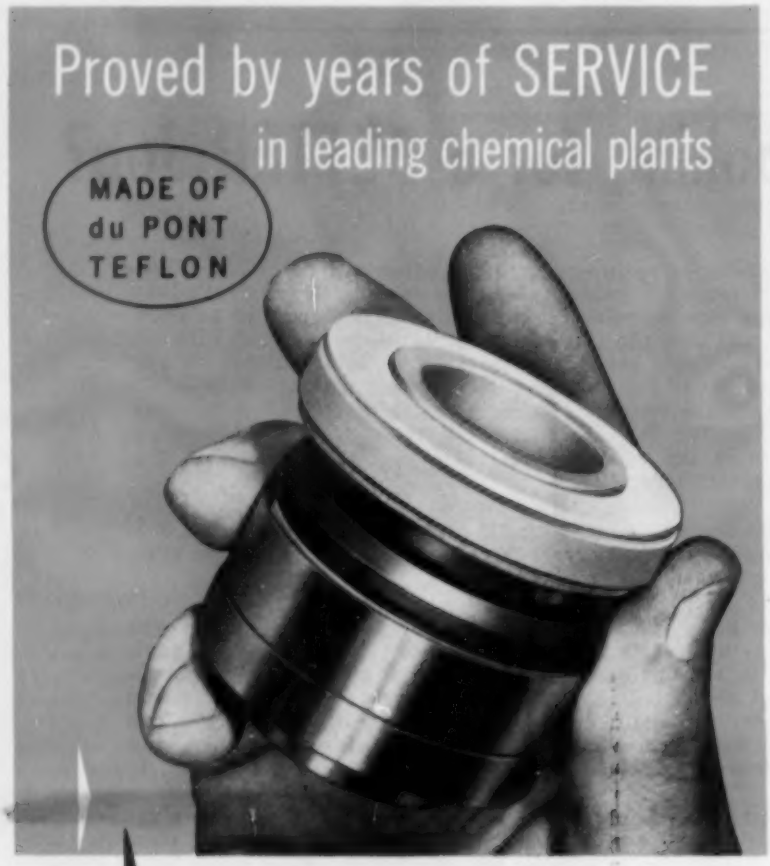
Location and Duties: You would welcome the chance to work in New York City, and you don't mind sitting behind a desk for a while, editing and rewriting other people's copy. Later (just as fast as you learn the ropes) you expect that you'll be given field assignments to gather data and write original articles.

Salary: You are now earning a respectable salary, and the chances are that this position will pay you even more right now—besides offering you the opportunity to rise more rapidly than you now expect to.

• If you think you are the man we want, send details on your background and experience (including salary history) to

William F. Bland, Editor
Petroleum Processing
330 West 42nd Street
New York 36, N. Y.

• If we think you are a qualified candidate, we will make arrangements for a personal interview. All replies will be held in the strictest confidence.



CHEMISEAL SHAFT SEALS

Customers report unsurpassed performance and much longer life under a wide variety of chemical service conditions, with Chemiseal Mechanical Seals.

A superior material—duPont TEFLON, and a one-piece balanced bellows design are responsible.

Chemiseals rotate with shaft. Only bearing surface is between precision ground stationary and rotating faces—the latter being an integral part of the TEFLON bellows unit.

Advantages include: Applicable to all chemical requirements, including clear, abrasive and tarry materials. Seal drop-tight and stay tight. Low friction load on shaft. No scoring of shafts—shafts already scored can be satisfactorily sealed. Pressures at the seal to 100 psi at 75° C or 75 psi at 100° C. Standard sizes ¾" to 2½". Other sizes on special order. Over-all length 2½".

Write for Bulletin No. MS-954.

UNITED STATES GASKET CO., Camden 1, N. J.

FABRICATORS OF FLUOROCARBONS AND OTHER PLASTICS

Representatives in principal cities throughout the world

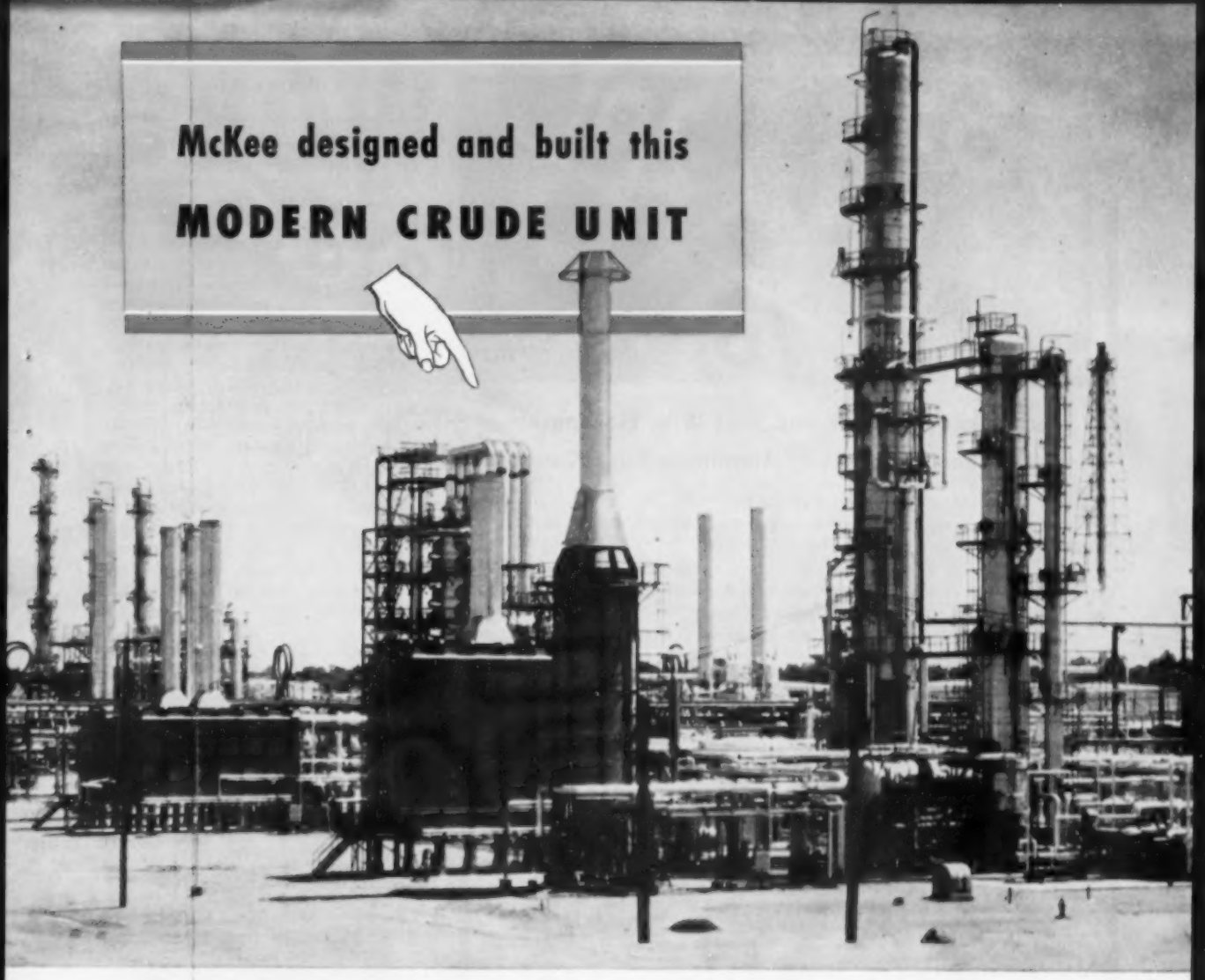
Corrosion-Proof Flooring

. . . is abrasion resistant, and resists the attack of solvents, acids and alkalis. Developed for application directly over concrete, the new material consists of a thermosetting resin liquid, a hardening agent and an aggregate-type filler. The material is mixed at the job site for immediate application. "Coro-Crete" handles like cement topping and is applied in thicknesses from ¼-in. minimum to ⅜-in. maximum (per layer). It cures in only a few hours time to a dense, impermeable and non-dusting surface. Adhesion to concrete is excellent, and it is two to four times more resistant to abrasion than most concrete floors. Company services include supervision for installation or contracting for the complete job, including labor, materials, equipment and supervision. The Ceilcote Co., Inc., 4911 Ridge Road, Cleveland 9, Ohio.

Circle No. **13** *on Reply Card*

Vapor Equivalent Bulbs

. . . measure natural gas residues rapidly and easily. The "Vapor Equivalent Apparatus"—a development of Phillips Petroleum Co.—will measure not only the vapor equivalent in resi-



...but McKee engineers are already working to improve the next

MAKE no mistake—the McKee men who engineered this plant put everything they had into it—expert knowledge, long experience, conscientious effort and great enthusiasm. It's the most modern and efficient plant of its kind—but McKee engineers are never satisfied. They're working now to find a better design, a more efficient layout, a faster, more economical method of construction for the next project.

That has been the story of McKee for half a century—a constant striving for improvement in design and methods. That's why, even though McKee engineers are never satisfied, McKee customers *always* are.

50th ANNIVERSARY

McKee Engineering Services

Arthur G. McKee & Company • Engineers and Contractors

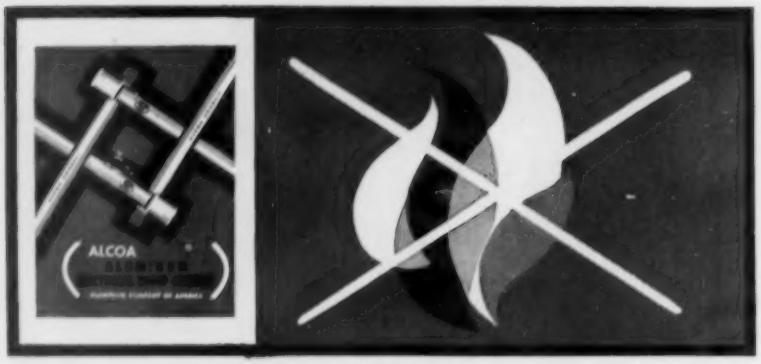
Headquarters: McKee Building • 2300 Chester Avenue • Cleveland 1, Ohio
Offices: New York, N. Y. • Union, New Jersey • Washington, D. C.
British Representatives of Metals Division: Head, Wrightson & Co., Limited
Canada: Arthur G. McKee & Company of Canada, Ltd., 350 Bay St., Toronto

dues from natural gas samples, but of any liquid with a vapor pressure of more than 4 mm at the temperature of the vaporization bulb. It is capable of measuring the volume of vapor produced by a unit volume of liquid in approximately 10 minutes, and can be used to determine molecular weights. The apparatus—mounted within a glass constant temperature bath—consists of a vaporization bulb with an integral multiplying manometer; a removable sample entry system consisting of an orifice and matching pyrometer; and an electric heater which operates on 115 volts a-c/d-c. Sensitivity is 1.5 ml for each milliliter on the manometer scale. Samples with molecular weights up to 120 can be run at 80°F., and samples from 72 to 150 can be determined at 130°F. Exclusive licensee—Central Scientific Co., 1700 Irving Park Rd., Chicago, Ill.

Circle No. **14** *on Reply Card*

Packless Solenoid Valve

. . . utilizes line pressure to assist opening and closing the valve. The valve, called the type "S," is designated for normally closed operation and provides a full port equal to the nominal pipe size opening. It may be applied to control automatically, or from remote points, the flow of steam, hot liquids and gasses not injurious to bronze, at fluid temperatures up to 400°F. An auxiliary operating piston integral with the disc holder assists the solenoid in opening the valve against higher line pressures—where at low or no pressure the solenoid alone will actuate the valve. The solenoid coil has class "H" insulation



Protect Against Sparks and Rust With Nonsparking, Corrosion-Resistant Alcoa® Aluminum Rigid Conduit!

Rigid conduit of Alcoa Aluminum protects petroleum processing plants against two costly things—sparks and rust. And costs less than any other corrosion-resistant, nonsparking, metallic conduit!

You'll find all the facts on this lowest cost, nonsparking, corrosion-resistant, rigid conduit in this book published by Alcoa. Facts on applications, advantages, installation and sizes. Send for your free copy, today.

Just fill out the coupon and mail to: ALUMINUM COMPANY OF AMERICA, 2324-G Alcoa Building, Mellon Square, Pittsburgh 19, Pennsylvania.

Your Guide to Aluminum Value

ALCOA RIGID CONDUIT MADE OF ALCOA ALUMINUM ALUMINUM COMPANY OF AMERICA

Gentlemen:

Please send me your book on the lowest cost, corrosion-resistant, nonsparking, rigid conduit: *Alcoa Aluminum Electrical Rigid Conduit.*

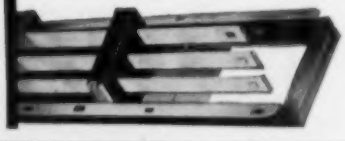
Name _____ Title _____

Company _____

Address _____

City _____ State _____

New Alcoa Aluminum Bus Conductor makes bus systems stronger, lighter; cuts costs! Bus systems using Alcoa's new No. 2 EC bus bar provide the best combination of strength, light weight and conductivity at a saving of up to 10%. Specify Alcoa Aluminum Bus Conductor.



Do You Have A Copy Of . . .

"REFINERY INSTRUMENTS—WHAT MAKES THEM TICK?"

A series of 8 articles by Cornelius E. Shannahan, instrument engineer with M. W. Kellogg Co., dealing with the four basic refinery instruments (pressure, temperature, flow, level), plus sections on controllers, control valves and pneumatic transmission.

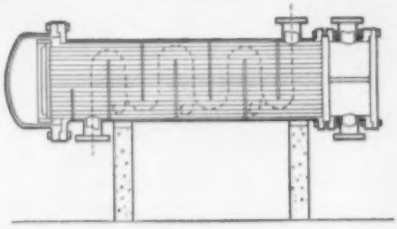
40 pages, 9¼x11¼, paper bound (1951-Z) $1.00

Address Reader's Service Department
PETROLEUM PROCESSING
330 West 42nd St, New York 36, N. Y.

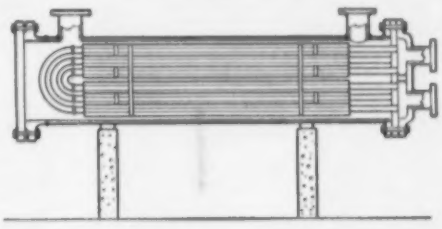
Note: New York City residents add 3% Sales Tax.

BROWN FINTUBE'S

BETTER DESIGN MEANS BETTER PERFORMANCE



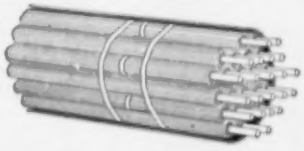
• Sectional View of Conventional Bare Tube Heat Exchanger Showing the Transverse Baffles that require the flow to make a series of 180° Bends, Resulting in Substantial Pressure Drop; Adding Unnecessarily to Pumping Costs; and producing Back Eddies, where Entrained Solids can Settle Out, Further Reducing the Heat Transfer Efficiency, and Increasing Cleaning and Maintenance Costs.



• Sectional View of Brown Fintube Bundle Exchanger. Fluid Flows through Hundreds of Long, Straight, Narrow Passages in Intimate Contact with the Heat Transfer Surface. The Only Pressure Drop Occurring Results from the Impingement of Flow Against the Heat Transfer Surface, and the Bends as the Fluid Enters and Leaves the Unit, Minimizing Pumping Costs, also Cleaning and Maintenance.

BROWN FINTUBE'S DESIGN ELIMINATES BAFFLES

Minimizing Pressure Drop



• View Showing the Banding of Alternate Fintubes to Prevent "Nesting", and Outer Bands that Produce a Tight, Compact Bundle of Long, Narrow, Straight Passages.

• The "bundle" in a Brown Fintube Exchanger consists of our integral "one-piece" fintubes connected with return bends; the other ends rolled into a tube sheet. A metal band strapped around each alternate fintube prevents "nesting", and the entire assembly is then banded tightly together.

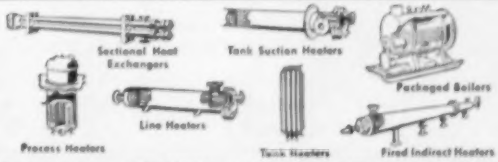
This construction produces hundreds of long, narrow, straight passages, through which the fluid flows. Carefully controlled velocities develop a turbulent flow, keeping heat transfer coefficients in a desirable range. There are no baffles, as when bare tubes are used, with their 180° bends to cause pressure drop, and create back eddies where entrained solids can settle out. In Brown Fintube exchangers, pressure drop results *only*, from the impingement of the fluid against the heat transfer surface, and the bends entering and leaving the unit.

The "one-piece" fintubes, available in carbon steel, alloy or non-ferrous metals, have 6 or 8 times more surface than plain bare tubing. They transfer more heat per lineal foot than plain bare tubing, saving space and weight;—and at lower temperatures per square foot of surface, preventing damage to heat sensitive materials.

Write for Bulletin No. 521. It lists dimensions and capacities of standard sizes. Other sizes and designs to meet any requirement. Write for your copy of Bulletin No. 521 *today!*

BROWN FINTUBE CO.

375 HURON ST., *Elyria, Ohio*



Engineering and Sales Representatives: NEW YORK • BOSTON • PHILADELPHIA • PITTSBURGH • BUFFALO • CLEVELAND • CINCINNATI DETROIT • CHICAGO • ST. PAUL • ST. LOUIS • KANSAS CITY • MEMPHIS • BIRMINGHAM • NEW ORLEANS • SHREVEPORT • TULSA • HOUSTON • DALLAS DENVER • LOS ANGELES AND SAN FRANCISCO • *Licensed Manufacturers:* BROWN FINTUBE (CANADA) LTD., ST. THOMAS, ONTARIO, CANADA BROWN FINTUBE (GREAT BRITAIN) LTD., BIRMINGHAM, ENGLAND • FRIEDRICH UHDE, GMBH, DORTMUND, GERMANY

CHEMICAL CLEANING HELPED BY PIPE LINE PIG

Dowell saved line replacement cost with fast combination treatment, restoring full capacity in 2½ hours!

Often, the most effective and economical way to clean lines is to use *both* chemical solvents and mechanical methods.

Take a recent case where thick iron oxide scale in a 12-inch water line had so reduced its capacity that costly replacement was necessary—*if cleaning failed*. Dowell engineers decided to use chemical solvents *and* a pipe line pig. Such a combination treatment is often used for speed and economy where scale is extremely hard or thick. In only 2½ hours, Dowell engineers removed the scale and restored the 398-foot line to full capacity.

Chemical cleaning by Dowell often saves you considerable downtime and money, because solvents are introduced through regular connections—dismantling and digging up of buried lines is unnecessary. Moreover, solvents are designed to clean the *entire line*—bends, elbows, valves, and any other hard-to-reach places.

Let Dowell chemical cleaning help restore and maintain the efficiency of lines and equipment in your plant. Call the nearest Dowell office, or write Dowell Incorporated, Tulsa 1, Oklahoma, Dept. G-32.

chemical cleaning service for industry

DOWELL

A SERVICE SUBSIDIARY OF THE DOW CHEMICAL COMPANY

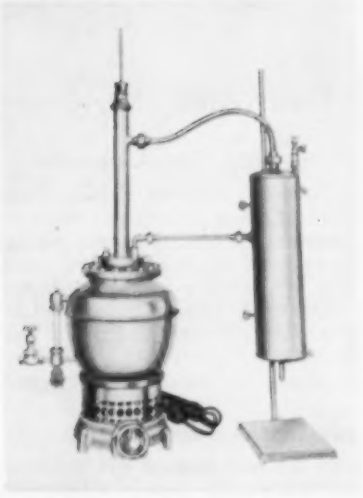
for continuous duty high heat service. The valve body is globe pattern—screwed ends—and available in sizes from ½-in. to 3-in., cast from high pressure bronze. The entire solenoid and operating mechanism may be removed and serviced without breaking the electrical leads or removing the valve body from the line. Magnatrol Valve Corp., Hawthorne, N. J.

Circle No. **15** *on Reply Card*

New Cracking Catalyst

. . . has high pore volume for increased stability and cracking efficiency. Based upon extensive field testing in cooperation with more than a dozen petroleum refineries, it is claimed that by bringing a combination of higher pore volume together with the most effective pore diameter, control of particle size distribution and hardness, the new catalyst achieves a stability making possible higher production yields of high octane products. Refining Chemicals Dept., American Cyanamid Co., 30 Rockefeller Plaza, New York 20, N. Y.

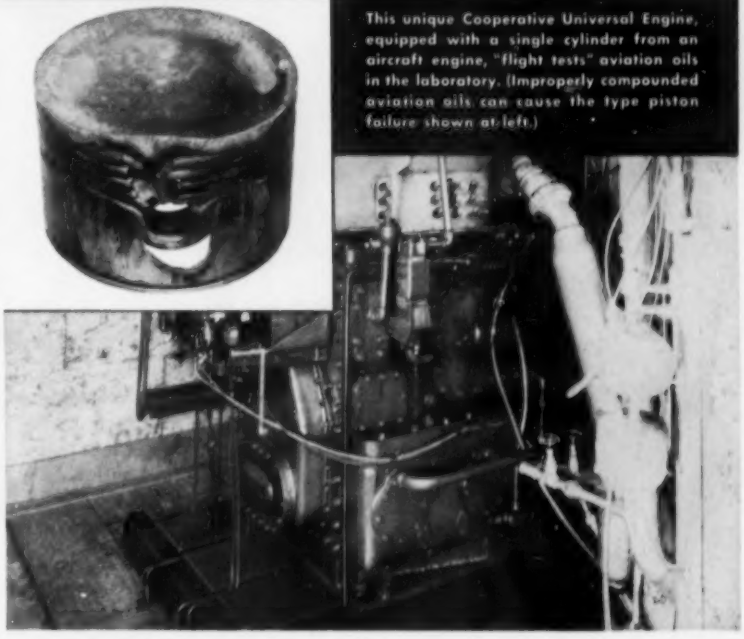
Circle No. **16** *on Reply Card*



Solvent Recovery Still

. . . recovers laboratory solvents where large amounts of such solvents are used for extraction. Redesigned from previous models, the apparatus is designed primarily for the recovery of carbon tetrachloride used in the determination of the bitumen content of asphaltic pavement mixtures, but is applicable for the recovery of petroleum ether, benzol, gasoline, alcohol, and other extraction vehicles. A three-heat hot plate permits rapid heating until distillation begins, and reduction of the heat thereafter to maintain

Where Oronite Lube Oil Additives helped improve aircraft oil performance



This unique Cooperative Universal Engine, equipped with a single cylinder from an aircraft engine, "flight tests" aviation oils in the laboratory. (Improperly compounded aviation oils can cause the type piston failure shown at left.)

Oronite additive research played a major role in establishing the cause and finding the solution to aircraft engine preignition from additive compounded oils. This extensive research resulted in a detergent type additive for aviation oils which will provide a marked reduction in engine deposits and wear without the hazard of preignition.

Oronite specializes in "custom-formulating" additives to your exact needs—meeting your price and performance specifications. Because of Oronite's advanced research program, elaborate testing and manufacturing facilities, Oronite's custom-compounding packs more into your oil at a given treating cost.

Why not talk over your problems with an Oronite additive specialist. Contact any Oronite office.

With Oronite Additives you can formulate oils to meet the new A.P.I. Service Classifications and can meet specifications for MIL-L-2104A, MIL-L-9000 Supplement I and Series 2 oils.

PARTIAL LIST OF OTHER ORONITE PRODUCTS

Gas Odorants
Polybutenes
Phenol
Wetting Agents
Fuel Oil Additives

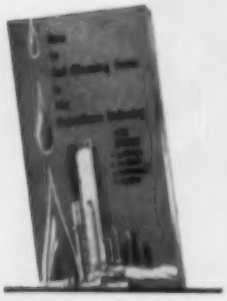
ORONITE CHEMICAL COMPANY
200 Bush Street, San Francisco 20, California
30 Rockefeller Plaza, New York 20, New York
20 North Wacker Drive, Chicago 6, Illinois
714 W. Olympic Blvd., Los Angeles 15, California
Mercantile Securities Building, Dallas 1, Texas
Carew Tower, Cincinnati 2, Ohio

ORONITE CHEMICAL COMPANY

(To obtain more data on advertised products see page 1056)

STORAGE TANKS

paint-stripped in less time—at less cost



SEND for this FREE Booklet. It is full of useful information on general maintenance . . . cleaning. Covers all divisions of the Petroleum Industry—production, processing, transportation, marketing.

BUT FAST—that's how old paint rolls off when you strip tanks the money-saving Oakite way.

Powerful Oakite strippers, applied by hot-flow-on, steam gun, or cold-flow-on method, actually float off paint, dirt and grease. You save time . . . no hand-scraping or chipping. You save money . . . long-life solution may be reclaimed and reused. No expensive sand blasting. And you're safe . . . no fire hazard.

Ask your local Oakite Technical Service Representative for on-the-spot demonstration. Or write for Booklet F7629. No obligation. Oakite Products, Inc., 44C Rector St., New York 6, N.Y.

. . . *Technical Service Representatives in Principal Cities of U.S. & Canada* . . . . .

OAKITE

TRADE MARK REG. U.S. PAT. OFF.

PETROLEUM SERVICE DIVISION

Every month in PETROLEUM PROCESSING . . .

. . . you will read details of all the new developments in processes and equipment you should know about . . . new plant methods . . . news of men and companies throughout the industry.

If you aren't reading PETROLEUM PROCESSING every month, why not start it coming now. The subscription prices are low—are shown on the index page of this issue. And, please indicate your company and position when writing us.

PETROLEUM PROCESSING

330 West 42nd Street, New York 36, N. Y.

the desired distillation rate. Vapor-locking is prevented by passing the raw solvent feed-line through the water-cooled condenser. Vapors passing up the feed-line are condensed and refluxed back into the retort. This arrangement of the feed-line also serves as a preheater for the solvent. Precision Scientific Co., 3737 W. Cortland St., Chicago 47, Ill.

Circle No. **17** *on Reply Card*

Improved Antiknock Mix

. . . acts to curb the increase in gasoline octane requirements of automobiles by reducing the accumulation of engine deposits. Key to the improved product is a change in the proportions of the chemical scavenging agents added to TEL to form the complete antiknock compound. This reduces the buildup of waste combustion products in the engine's combustion chambers, thus reducing the octane requirement increase and surface ignition caused by these deposits. "Motor Plus" can lower the octane requirements of automobiles by as much as one octane number according to the manufacturer. Ethyl Corp., Houston Plant, P.O. Box 472, Pasadena, Texas.

Circle No. **18** *on Reply Card*

Free Trade Literature

Recording Spectrometer

. . . in the ultraviolet, visual and near infrared ranges for process control and research: 20-page brochure on the *Spectracord* describes features, operation, accessories and performance with examples for benzene and chloroform recordings. Warren Electronics Inc., Bound Brook, N.J.

Circle No. **19** *on Reply Card*

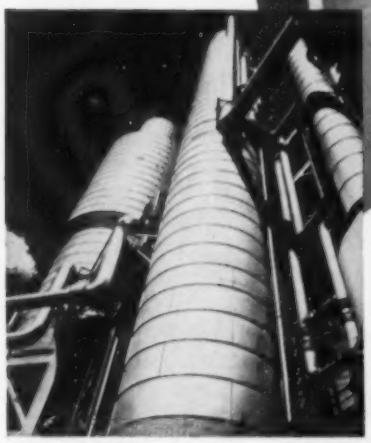
pH Instrumentation

. . . for measurement and automatic control: 38-page *Bulletin Q1304* contains drawings and photos of installations in petroleum and petrochemical fields giving application and installation information. The Bristol Co., Waterbury 20, Conn.

Circle No. **20** *on Reply Card*

Synthetic Ammonia

. . . using one of four different basic plant types to generate synthesis gas, tailored to suit local conditions and feed materials: 12-page booklet *Synthetic Ammonia* details purification methods and use of steam reforming, catalytic partial oxidation, non-cata-



Stainless-clad and monel-clad steels combine to handle corrosive asphalt crude containing up to 2.5% sulfur concentrations at 750° F in this vacuum still.

STRUCTURAL STABILITY— Low-cost carbon steel backing provides necessary strength and rigidity.

DESIGN FREEDOM— Integral bond allows design and fabrication of shapes to meet process and space needs.

ECONOMY— High-alloy layer assures corrosion resistance, long equipment life.

CLAD STEEL EQUIPMENT GIVES SOLID HIGH-ALLOY PROTECTION AT LOWER COST

With protection against the corrosive action of sulfuric feeds at high temperatures a "must" to avoid unscheduled shutdowns, clad steel equipment is often the *economical* answer. Cladding and backing are permanently and integrally bonded over their entire surface, eliminate the chance of seepage or crevice corrosion. Smooth, uniform clad surfaces permit easy cleaning, drainage and inspection.

Why not investigate clad for your new processing equipment. Lukens Clad Steels—stainless, nickel, Inconel, Monel, copper—give you all the advantages of these solid high-alloys with savings up to 50% in material costs.

In addition to low first cost, clad steel permits easy and economical field erection. When you're thinking of new tanks and pressure vessels, *qualified* equipment builders can help you take advantage of the versatility of Lukens Clad Steels. Working with your engineers and consultants from the start, they tailor equipment to your exact needs. We offer the widest range of clad steels available and work closely with fabricators to help select the type most suited to your processing needs. If you would like further information, ask one of your builders or write Manager, Marketing Service, Lukens Steel Company, 752 Lukens Building, Coatesville, Pennsylvania.

LUKENS CLAD STEELS

STAINLESS-CLAD · NICKEL-CLAD · INCONEL-CLAD · MONEL-CLAD

PRODUCER OF THE WIDEST RANGE OF TYPES AND SIZES OF CLAD STEEL PLATES AND HEADS AVAILABLE

(To obtain more data on advertised products see page 1056)

lytic partial oxidation and low-temperature raw gas conversion with flow diagrams; includes two case histories with investment and operating costs. The M. W. Kellogg Co., 225 Bdwy., New York 7, N.Y.

Circle No. **21** *on Reply Card*

Stainless Steel Valve

. . . design, selection, maintenance and repair: 12-page *Catalog No. 55, Valve Technical Data* discusses the principles of construction and operation of the standard valve types, etc. Cooper Alloy Corp., Hillside 5, N.J.

Circle No. **22** *on Reply Card*

Glycols and Triols

. . . available in commercial or development quantities: 60-page *"Glycols" (F-4763)* describes uses and suggested applications for glycols and gives properties, shipping information, specifications, test methods, and constant-boiling mixtures. Carbide and Carbon Chemicals Co., 30 E. 42nd St., New York 17, N.Y.

Circle No. **23** *on Reply Card*

Water Treating Pumps

. . . of the controlled volume type for use in coagulation systems, lime soda softening, hot process softeners, demineralization, etc.: 24-page *Bulletin No. 953* describes the water treating processes and discusses cooling tower water treating and systems for waste and sanitary water treatment. Milton Roy Co., 1300 East Mermaid Lane, Philadelphia 18, Pa.

Circle No. **24** *on Reply Card*

Cleaning Maintenance

. . . services for the process industries: data sheet describes the services performed in the chemical cleaning of process machinery. Dowell Inc., P. O. Box 536, Tulsa 1, Okla.

Circle No. **25** *on Reply Card*

Sintered Bronze Filters

. . . for any liquid or gas at any temperature: 16-page catalog *Modern Filtration* includes information on advantages and engineering data for filters already being produced for many industries. Permanent Filter Corp., 1800 W. Washington Blvd., Los Angeles 7, Calif.

Circle No. **26** *on Reply Card*

Strain Gage & Accessory

. . . equipment for pressure measurement: 12-page *Domestic Price List* is for gages, instruments, accessories and

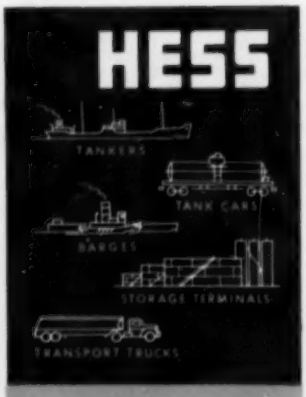
Hess bulk liquid storage terminals are never closed!

When storing bulk liquids at HESS, you know the gate will never be closed. HESS is ready to receive or release your product any time you want it . . . 24 hours a day, including Sundays and holidays.

HESS has huge, conveniently located bulk-storage plants in the New York Harbor and Gulf Coast areas. HESS is equipped to store chemicals, petrochemicals, petroleum products and other liquids — in individual tanks, in quantities, from 10,000 gallons to 10,000,000.

Your material is received and released through modern pumping, piping and drumming facilities, via rail, truck, barge or tanker. Your product is handled by experts. Complete pipeline and storage privacy guarantees absolute product purity.

You'll like doing business with HESS. Reserve your copy of new illustrated book, telling the whole story of how your product will be handled and stored. Address your inquiry to our location nearest you so that we can give it immediate attention.



HESS, INCORPORATED
Perth Amboy, N. J.
VAlley 6-1000

HESS TERMINAL CORP.
Houston, Texas
Glendale 3-7195

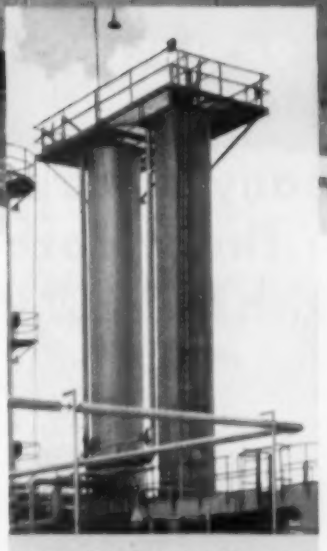
(To obtain more data on advertised products see page 1056)

Does your process call for *drying?*

Reynolds Activated Alumina Removes 12,500 Gallons of Water Per Hour in Operation of Supersonic Tunnel

At Lewis Flight Propulsion Laboratory, Cleveland, the 10x10 foot Supersonic Tunnel above has a design capacity of 1,440,000 cfm. Low cost Reynolds Activated Alumina is used in six large beds totaling 25,000 square feet to reduce this volume of air to a dew point of −40° F. (Inlet conditions; 85° F dry bulb, 78° F wet bulb, 68° F dew point.) In some applications, Reynolds Activated Alumina will adsorb up to 22% of its weight. It can be regenerated repeatedly by heating with little loss of efficiency.

Reynolds regional offices offer you the service of staff engineers and other specialists in the use of aluminum chemicals, shipping containers and mill products. For your copy of Free Brochure "Reynolds Aluminum Chemicals", write *Reynolds Metals Company, P.O. Box 1800-CS, Louisville 1, Kentucky.*



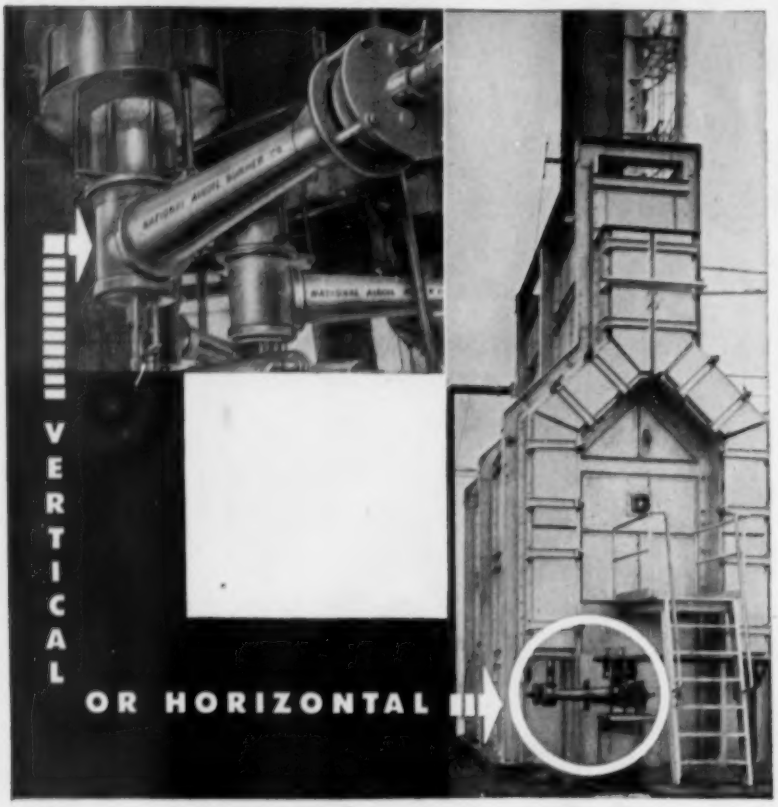
Reynolds Activated Alumina Used in HF Alkylation at Texas City Refining

The use of Reynolds Activated Alumina at Texas City Refining Inc. reflects the high suitability of this material for drying of hydrocarbon feeds in many processes such as HF alkylation.

Reynolds Activated Alumina in these processes provides elimination of silica migration, better fluoride removal and thorough drying of alkylate while in process.

REYNOLDS CHEMICALS

BY THE MAKERS OF REYNOLDS ALUMINUM



many more hours on stream without forced shutdown with NATIONAL AIROIL

OIL-GAS TANDEM COMBUSTION UNITS

Exclusively for vertical firing, the new National Airoil VERTICAL Tandem Block Units retain all the features of our regular horizontal Tandem Units . . . *plus:* special, pre-cast refractory shapes for easier, cost-saving vertical installation and maintenance; secondary air inlet louvres for positive control of vertical flame pattern; and, all steel duplex detaching gear which enables swift, simple vertical burner changeover.

VERTICAL and HORIZONTAL Tandem Units hold air in the combustion zone until fuel and heated air are thoroughly mixed. This means that ignition takes place in a hot zone; the result: high fuel economy through more rapid combustion with a minimum of excess air. NATIONAL AIROIL's patented Tandem Combustion Units allow secondary air to be easily and accurately controlled. By adjusting air control louvres, flame can be shaped to radiate heat uniformly without tube impingement.

The VERTICAL or HORIZONTAL Tandem Unit is always fired with NATIONAL AIROIL Combination Oil and Gas Burners . . . has a high turndown ratio with a steady flame temperature using either fuel oil or gas. With the TANDEM UNIT'S clean flame, a cold furnace can be brought to full capacity in a short time.

"Many, many more hours on stream, without shutdown" . . . yes, YOU will realize higher profits from YOUR heaters when NATIONAL AIROIL VERTICAL or HORIZONTAL Tandem Units are specified. Our new Bulletin 498 is yours for the asking.

NATIONAL AIROIL BURNER CO., INC.

CHEMICAL-PETROLEUM DIVISION

Main Office & Factory: 1254 EAST SEDGLEY AVE., PHILADELPHIA 34, PA.

Southwestern Division: 2512 South Boulevard, Houston 6, Texas

INDUSTRIAL OIL BURNERS, GAS BURNERS, FURNACE EQUIPMENT

cements including specifications for all sizes and types of bonded resistance wire strain gages, and telling how to select the right gage for various conditions. Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.

Circle No. **27** *on Reply Card*

Thermocoup'e Equipment

. . . for fast response: 20-page *Catalog 1542* describes principles and specifications for thermocouple assemblies and pressure sealing glands for both "bare wire" and "speedwell" principles. Conax Corp., 7811 Sheridan Drive, Buffalo 21, N.Y.

Circle No. **28** *on Reply Card*

Boiler Feed Pumps

. . . of the horizontal, multi-stage, diffuser type with single inlet impellers in series: 12-page *Bulletin 122* discusses service ratings and construction —using cutaway drawings—includes formulae for calculating net inlet head and a graph for density and vapor pressure conversion, lbs./hr. to gpm water at different temperatures. Pacific Pumps Inc., Huntington Park, Calif.

Circle No. **29** *on Reply Card*

Welding Cost Analysis

. . . using semi and full automatic electric arc welding for seams on cylindrical and elliptical vessels: *Engineering Data Sheet "Automatic Welding Cost Analysis"* gives charts comparing manual and automatic welding speeds. Pandjiris Weldment Co., 5151 Northrup Ave., St. Louis 10, Mo.

Circle No. **30** *on Reply Card*

Control Instruments

. . . for the process industries, and available as immediate stock shipment items: 24-page *Catalog 2* gives complete specifications, dimensions, prices, capacities and construction materials on flow meters, recorders, controllers, flow test kits, chemical feeders, etc. with sizing nomographs, panel mounting diagrams, safe working pressure tables and basic operating data. Fischer & Porter Co., 397 Jacksonville Road, Hatboro, Pa.

Circle No. **31** *on Reply Card*

Vapor Pressure Charts

. . . for use as standards for specification and control purposes in the production, refining, and sales branches of the industry: 20-page booklet, *Vapor Pressure Charts for Petroleum Hydrocarbons* has been approved for distribution by the API Committee on Petroleum Products. The American

stability...

just one of many reasons why KAYLO® is the king of high temperature insulations

Other high temperature insulations may look like Kaylo—but performance brings out the difference. Take stability, for instance.

Even when soaked in water for long periods, or immersed in boiling water, Kaylo (hydrous calcium silicate) not only refuses to break down but, after drying out, shows no apparent shrinking or warping! And its original thermal efficiency and exceptional strength return, too! Moreover, it can be removed and replaced for line inspection without waste.

No wonder Kaylo is called "king of high temperature insulations!"

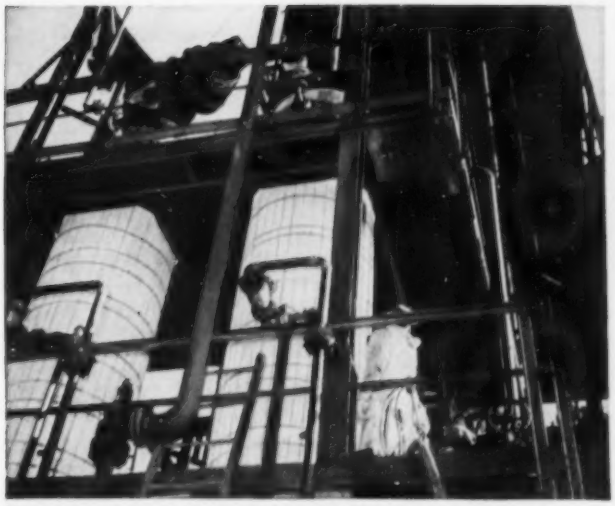
Together with Fiberglas*—the world's leading industrial insulation—Kaylo rounds out the most complete and versatile line of plant insulations available. It is distributed by Owens-Corning Fiberglas Corporation, and is made both as block and molded pipe insulation with the widest range of sizes, forms and thicknesses of any high temperature insulation.

For complete technical data, see our listings in Sweet's File, Chemical Engineering Catalog, or Refinery Catalog. Or write: Owens-Corning Fiberglas Corp., Dept 185-G, Toledo 1, Ohio.

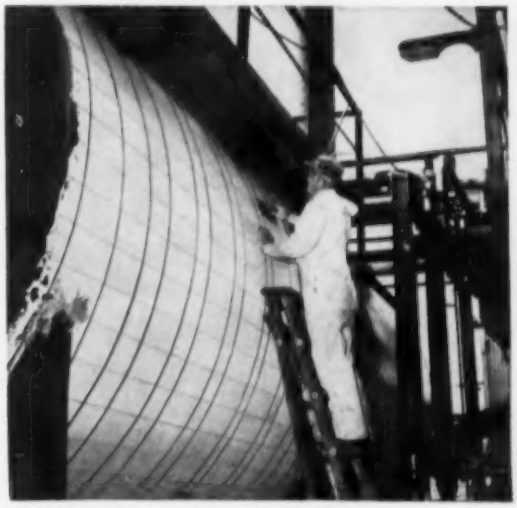
Kaylo and Fiberglas now provide you with complete coverage from lowest sub-zero to 1200° F — from one reliable supplier.

OWENS-CORNING
FIBERGLAS

* T. M. Reg. Owens-Corning Fiberglas Corporation
® Kaylo is mfd. by Owens-Illinois Glass Co., Inc.



Kaylo on a pair of "strippers" in a fractionating plant, one of an increasing variety of industrial applications.



Kaylo block on desalter tank. Strength of material and large units mean more economical application, less waste.

reodorize petroleum malodors

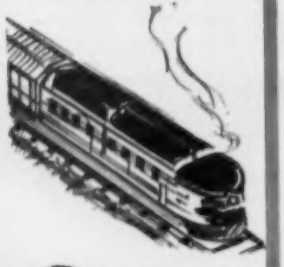
with *Alamask!*

Make olfactorily acceptable petroleum products!

Producers of petroleum products and of petro-chemicals — by adding a selected ALAMASK reodorant — can improve odor characteristics of such materials. A specific ALAMASK is available to achieve adequate reodorization of a variety of petroleum products.

FOR REODORIZATION OF:

FUEL OILS *(regular or premium gasoline blends)*
KEROSENE
DIESEL OILS
CUTTING OILS and SPECIALTIES
many other petroleum products



Gain olfactory relief with an ALAMASK.

Write, wire or phone for specific information. Our Engineering Section provides complete technical guidance.

Rhodia INC.
230 Park Avenue, New York 17, N. Y.
PLANT: PATERSON, N. J.

Are You Moving?

Please let us know as soon as you can so we can change your subscription stencil addressing plate. Be sure to send us

(1) Your *old* address (including company connection)

(2) Your *new* address (including company connection)

(3) The *date* the change becomes effective

PETROLEUM PROCESSING—Subscription Department
330 West 42nd Street—New York 36, N. Y.

Petroleum Institute, 50 W. 50th St., New York 20, N.Y.
Circle No. **32** *on Reply Card*

Prefabricated Quiet Room

. . . for offices and recreation rooms in noisy areas: *Bulletin SP-21* describes construction and erection of prefabricated soundproof rooms for use in factories, plants and other noisy areas. Industrial Acoustics Co., Inc., 341 Jackson Ave., New York 54, N.Y.
Circle No. **33** *on Reply Card*

Centrifugal Pumps

. . . for acids, alkalies and slurries: 20-page *Bulletin W-350-B14B* describes construction, gives seven pages of rating charts for both 50 and 60 cycle speeds, discusses stuffing box operation, gives parts lists, etc. Worthington Corp., Harrison, N.J.
Circle No. **34** *on Reply Card*

Activated Carbon

. . . for purification of liquids, decolorizing, filtration, etc.: *Technical Bulletin No. 13* describes nature, characteristics and applications of various extra-hard granular and powdered adsorbent activated carbons and discusses evaluation methods and use in continuous and batch processes. Adsorbite Div., Barnebey-Cheney Co., Cassady at E. 8th Ave., Columbus, Ohio.
Circle No. **35** *on Reply Card*

Boiler Burner Controls

. . . providing for starting and operating flame failure protection for one, two, three or four burners by "scanning" of flame: *Installation Bulletin CC-31* describes "Fireye" integrated control systems, gives specifications, mounting instructions and servicing information. Electronics Corp. of America, 720 Beacon St., Boston 15, Mass.
Circle No. **36** *on Reply Card*

Spectrophotometer

. . . for operation over the infrared, near infrared, visible and ultraviolet ranges: bulletin *FD-64-225* describes the "Model 13-U," gives typical spectra, complete specifications and accessory descriptions. The Perkin-Elmer Corp., Norwalk, Conn.
Circle No. **37** *on Reply Card*

Adaptability Testing

. . . to measure mental adaptability or mental alertness as an employment aid—in identifying persons who can be placed on jobs that require rapid

POWELL VALVES . . . THE COMPLETE QUALITY LINE . . . POWELL VALVES

. . . THE COMPLETE QUALITY LINE . . . POWELL VALVES . . . THE COMPLETE QUALITY LINE . . .

POWELL LUBRICATED PLUG VALVES

FIG. 3059G—300-Pound Steel Flanged End Valve. Sizes 6" to 12".

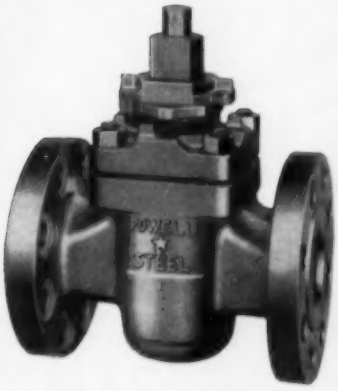


FIG. 1559—150-Pound Steel Flanged End Valve. Sizes 1" to 4".

. . . THE COMPLETE QUALITY LINE . . . POWELL VALVES . . . THE COMPLETE QUALITY LINE . . .

POWELL VALVES . . . THE COMPLETE QUALITY LINE . . . POWELL VALVES

Powell Valves—the *complete* quality line—offer many outstanding features in these new Lubricated Plug Valves, such as quick and sure operation and a positive seal when the valve is closed.

Valves are available with screwed or flanged ends; single, screwed and bolted gland types, and in Semi-Steel, Carbon Steel, Bronze, Ni-Resist, Monel Metal, and Stainless Steel. Semi-Steel valves are rated 175 and 200 pounds W.O.G.; Steel valves, 150 and 300 pounds W.P. Sizes from 1" to 12". Valves in sizes 6" and larger can be furnished with gears for gear operation. Distributors located in principal cities. For descriptive literature—or help on valve problems—write direct to

The Wm. Powell Company, Cincinnati 22, Ohio.....109TH year

GLITSCH

BUBBLE CAPS...

ANY SHAPE
ANY SIZE . . .

Existing dies of 287 different cap and riser designs, as well as data on various ratios of related areas, are available to your engineers during planning stages. Practical ideas for improvements to keep apace constantly changing petroleum refining and chemical processing are a GLITSCH service of world-wide proportions.

GLITSCH "TRUSS-TYPE" TRAYS

Lightweight, simple, adaptable with complete freedom of layout, GLITSCH "Truss-Type" mechanical design is not restricted to standardized patterns. You specify your process requirements.

Your engineering staff can effect definite savings in initial designing through GLITSCH world-wide experience in plans, design and fabrication of tower internals.

Cost analyses of tower internal equipment for fabrication in a wide range of material are available promptly.

Glitsch
FRITZ W. GLITSCH & SONS, INC.
P. O. Box 6227
DALLAS 2, TEXAS

SALES OFFICES: New York • Chicago • Cleveland • Houston • Tulsa • Los Angeles

Do You Need More Engineers?

Order your reprint today of this popular and helpful article from the May issue of PETROLEUM PROCESSING, telling how some oil companies are easing the shortage of engineers without increasing their staff.

Single copies	50¢ each
Up to 10 copies	30¢ per copy
Up to 49 copies	25¢ per copy
Up to 99 copies	20¢ per copy
100 or more copies	15¢ per copy

Address: Readers Service Department
PETROLEUM PROCESSING
330 West 42nd Street, New York 36, N. Y.

Note: New York City residents add 3% sales tax

learning, and in identifying those who do not readily adapt to new situations and should be on repetitive jobs. Science Research Associates, 57 W. Grand Ave., Chicago 10, Ill.

Circle No. **38** *on Reply Card*

Finned Tube Exchange

. . . with longitudinal fins, having six to eight times the exterior surface of the same length of bare tubes: bulletin discusses "G-Fin" tubes, their manufacture, sizes available and materials of construction. The Griscom-Russel Co., Massillon, Ohio.

Circle No. **39** *on Reply Card*

Process Valves

. . . used in the petroleum and gas industries: *Bulletin No. GV-11* describes the gate valve line blind, self-closing sampling valve, vertical-swing horizontal check valve, triple action quick closing valve and tank truck vapor recovery unit giving information of construction, specifications, installations, and a price list. Greenwood Valve Div., Vernon Tool Co., Ltd., Alhambra, Calif.

Circle No. **40** *on Reply Card*

Laboratory Equipment

. . . for research and analysis activities: 20-page *What's New for the Laboratory, No. 23, 1955* lists laboratory apparatus and materials with detailed descriptions and prices. Scientific Glass Apparatus Co., Inc., 100 Lakewood Terrace, Bloomfield, N.J.

Circle No. **41** *on Reply Card*

Nylon Instrumentation

. . . for new nylon intermediates plant erected in Canada: *Taylor Technology, Winter 1955 Issue, Vol. 7, No. 3* gives description of the duPont Maitland, Ont. plant instrumentation with photographs and discussion. Taylor Instrument Companies, Rochester 1, N.Y.

Circle No. **42** *on Reply Card*

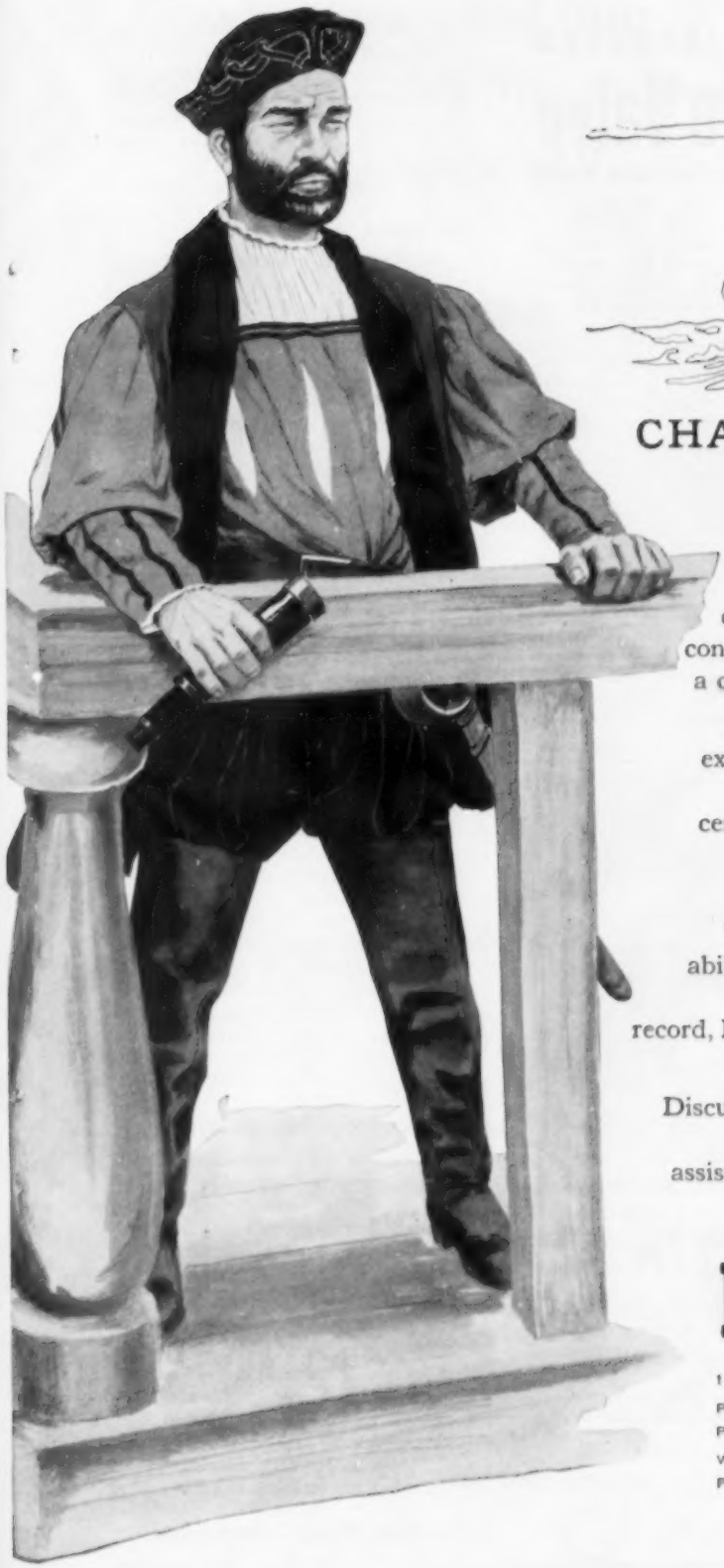
Spectrophotometry

. . . for determining sulfides in crude petroleum: reprint from *Analytical Chemistry, "Spectrophotometric Determination of Aliphatic Sulfides in Crude Petroleum Oils and Their Chromatographic Fractions"* discusses theory, method, and results. Mellon Institute, 4400 Fifth Ave., Pittsburgh 13, Pa.

Circle No. **43** *on Reply Card*

Gasoline Qualities

. . . and antiknock ratings representative of 53 marketing centers in the U.S.: *Gasoline Antiknock Quality,*



CHARTING A COURSE FOR THE FUTURE

Like the rugged seafarers of an earlier century, modern industrial organizations are continually faced with the problems of charting a course which will ensure their future success.

And when the designated route requires the expansion or modernization of their processing facilities, these organizations must be certain that the construction firm selected for the job will be one with an outstanding record of past achievements.

Throughout the world, Procon has shown its ability to handle any process construction work efficiently and economically. With such a record, Procon has enabled its many clients to enjoy the benefits of rapid on-stream operations.

Discuss your next process construction job with a Procon engineer. You'll find him ready to assist you in planning your course for the future.

PROCON *Incorporated*

1111 MT. PROSPECT ROAD, DES PLAINES, ILLINOIS
PROCON (CANADA) LIMITED—40 ADVANCE ROAD, TORONTO
PROCON (GREAT BRITAIN) LIMITED—112 STRAND, LONDON
WORLD-WIDE CONSTRUCTION FOR THE PETROLEUM, PETROCHEMICAL, AND CHEMICAL INDUSTRIES

PROCON ®

NEW

ALL-JACKETED

Gate Valve

with Replaceable Seats

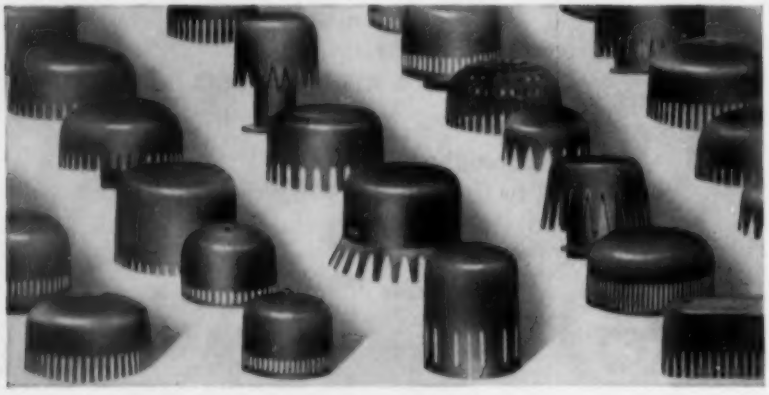
Valves in line size 1½" through 4" available in cast iron, steel, bronze, Ni-Resist and stainless steel.

Valves in line size 6" through 12" are made of fabricated steel or stainless steel.

● The H&B "all-jacketed" gate valve does not need to be removed from the process line to re-machine the seats. Replacement inserts can be installed in a matter of minutes, minimizing shut-down time . . . Also jacketed pipe, fittings, plug cocks, pumps, meters, flexible hose. Write for Catalog J-50.

HETHERINGTON & BERNER INC. • *Engineers, Manufacturers*

715 KENTUCKY AVENUE INDIANAPOLIS 7, INDIANA



SEND FOR PSC

BUBBLE CAP BULLETIN 22

Largest Compilation of Engineering Data.

Lists 300 Styles Furnished Without Die Cost.

This standard reference on bubble caps and risers contains complete specification information for hundreds of variations. Also many drawings for use in determining methods of tray assembly. With dies on hand for all listed styles, PSC can save you substantial die costs as well as design and delivery time. Furnished in any drawing type of metal, to meet your coking or corrosion problems. Assemblies will also be produced to your specifications.

THE PRESSED STEEL CO., 711 N. Penna. Ave., Wilkes-Barre, Pa.

PSC

Custom Fabricators for the Process Industries Since 1928. Send Your Blue Prints.

May 1955 presents data based on approximately 850 samples purchased at service stations, and gives average research octanes for premium and regular grades for the past year by months. Ethyl Corp., 100 Park Ave., New York 17, N.Y.

Circle No. **44** *on Reply Card*

Oxygen Analysis

. . . in continuously-flowing gas samples or fixed volume samples as small as 3 cc: *Bulletin No. 144* describes the portable "Model C" oxygen analyzer giving its principle of operation, features, applications and gas sample requirements. Arnold O. Beckman, Inc., 1020 Mission St., South Pasadena, Calif.

Circle No. **45** *on Reply Card*

Process Strainers

. . . for removing fine suspended particles from raw or process water, oil, gasoline, alcohol, etc.: 26-page brochure contains photos, descriptions, dimensions, capacities, installations and pertinent engineering information. S. P. Kinney Engineers, Inc., 201 Second Ave., P.O. Box 445, Carnegie, Pa.

Circle No. **46** *on Reply Card*

Evaporation Losses

. . . reduced by the use of urea-formaldehyde "Colfoam Microballoons": brochure describes their use with stored crude oil or volatile petroleum products, present and possible applications, physical properties, installation, effect of plastic microballoons on stored products, expected life of microballoons and services to assist in initial installations. Colton Chemical Co., 1545 E. 18th St., Cleveland 14, Ohio.

Circle No. **47** *on Reply Card*

Laboratory Equipment

. . . for analysis and research work: 16-page *Daigger Apparatus Digest, Issue #2* lists a variety of laboratory materials and apparatus with descriptions and prices. A. Daigger & Co., Kinzie at Wells St., Chicago 10, Ill.

Circle No. **48** *on Reply Card*

Conveyor Systems

. . . planned for oil refineries and other industries: 26-page *Catalog 309* discusses vertical, gravity, chain and belt conveying. Standard Conveyor Co., North St. Paul 9, Minn.

Circle No. **49** *on Reply Card*

Flexible Pipe Connectors

. . . to solve vibration and expansion control problems in industrial and

what are good little Yarway Impulse Steam Traps made of?

STAINLESS STEEL, *of course*

Body and all internal parts of YARWAY Impulse Steam Traps are of *stainless steel*—one of the biggest steps taken by any trap manufacturer to increase trap life and reduce maintenance.

Other YARWAY Impulse Steam Trap features:

- **Gets equipment hot in a hurry—and keeps it hot.**
- **Good for all pressures without change of valve or seat.**
- **Easy installation—small size, light weight.**
- **Non-freezing at low temperatures.**
- **Six standard sizes, ½" to 2".**

Want *proof* of performance? Try a YARWAY Impulse Trap and Fine Screen Strainer FREE for 90 days in your own plant. For free trial or free Trap Selector, write . . .

YARNALL-WARING COMPANY
153 Mermaid Ave., Philadelphia 18, Pa.

OVER 1,000,000 YARWAY IMPULSE TRAPS SOLD—STOCKED BY 270 CONVENIENT INDUSTRIAL DISTRIBUTORS

YARWAY
impulse
steam trap

How can I reduce tube cleaning down-time ?

...with AIRETOOL tube cleaners!

SUBTRACT costly downtime

Coke and clogged tubes eat a big hole in a cost control sheet. It's natural then, that more and more refineries are coming to rely on the realistic savings Airetool tube maintenance equipment adds.

Take the Airetool "6000" series of cleaners for example. In matter of minutes (not hours), they whisk away profit-stealing deposits from tubes that slow up your production.

Airetool ball-bearing motor with single expansion cutter head for cleaning straight tubes. Motor is slip-fit constructed, and has front and rear ball-bearing thrusts.

MULTIPLY precious profit

Reliable reports from many make this a fact.

Maybe you want to subtract some of that costly downtime from your tube maintenance jobs — by adding the advantages of Airetool.

We'd be happy to prove our point on the toughest tube assignment you can come up with. Write us direct — or if you prefer — call in the Airetool representative nearest you.

"There's an Airetool Tube Cleaner and Tube Expander for Every Type of Tubular Construction."

AIRETOOL
MANUFACTURING COMPANY
SPRINGFIELD, OHIO

BRANCH OFFICES: New York, Chicago, Philadelphia, Houston, Tulsa, Baton Rouge. Representatives in principal cities of U.S.A., Canada, Mexico, South America, England, Puerto Rico, Hawaii, Japan, Italy
EUROPEAN PLANT: Airetool Nederland N.V., Vlaardingen, The Netherlands

process piping: 12-page *Catalog No. EZ-55* describes the "ExpandZorber," a stainless steel welded diaphram-type, packless expansion joint, gives pressure and temperature application ranges, dimensions, specifications and special-purpose joints. R. R. Finn & Co., Inc., Industrial Division, Hawthorne, N.J.

Circle No. **50** *on Reply Card*

Fused Silica

. . . for laboratory equipment which is resistant to high temperature and thermal shock and is acid proof and electrically insulating: bulletin gives physical specifications and descriptions; sizes of tubing, crucibles and evaporating dishes available. Amersil Co., Inc., 685 Ramsey Ave., Hillside 5, N.J.

Circle No. **51** *on Reply Card*

Did You Miss These?

The following items, reviewed originally in April, have aroused considerable interest among the readers. They are repeated briefly as a service to those who might have missed them the first time they appeared. For details or literature, please use the regular Reply Card in this issue.

Oil Industry Explanations

. . . for individuals, schools or other groups explaining the complex operation of the oil industry in clear, simple language: 32-page *The Story of Petroleum* tells how exploration crews hunt oil, how drilling crews sink wells, how pipelines move oil to refineries, how chemists and engineers refine crude oil, and how the people in distribution operate, etc. Shell Oil Co., 50 W. 50th St., New York 20, N. Y.

Circle No. **52** *on Reply Card*

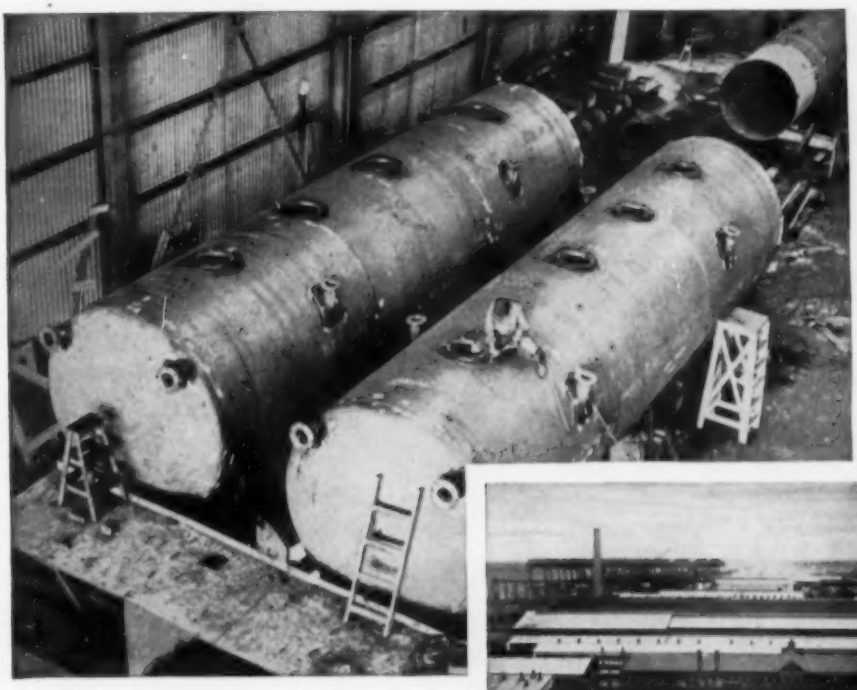
Uranium in Colorado

. . . in the colorful mesa country where thousands of people are mining and processing uranium ores: 36-page *Mesa Miracle* describes the fast growing uranium industry and includes up-to-date figures on mines now in operation and other information. United States Vanadium Co., Room 308, 30 E. 42nd St., New York 17, N. Y.

Circle No. **53** *on Reply Card*

Catalytic Desulfurization

. . . of petroleum distillates: *Heat Engineering, Jan.-Feb. 1955* discusses catalytic desulfurization without hydrogen,



A Mile of Shops – Each shop is devoted to a special type of heavy production. Included are complete Machine Shops, casting, forging and other facilities which offer all of the advantages of the execution of the complete job.

A half mile of pressure vessels

These are two of seventy – over ½ mile – of 38½-foot vacuum tank casings built to meet the quality requirements of a well-known processor.

The buyer also benefits from many savings made possible by Newport News extensive heavy fabrication equipment and the sixty years experience in using it.

Do you plan installations of heavy production equipment? You can command the services of Newport News for weldments of corrosion-resistant, alloy and clad metals in almost any size or shape, plus the required engineering background and complete welding and stress-relieving skills.

It will pay you to get the facts, shown in *Facilities and Products*. As you glance at its photos and brief captions, you'll see why Newport News can turn out – at low cost – specialized heavy equipment for process plants.

Send for *Facilities and Products* – free – today.

Newport News
Shipbuilding and Dry Dock Company
Newport News, Virginia

Why
do most users
prefer and buy the genuine
RIDGID
PIPE WRENCH?

It's easiest to work with . . . perfect balance . . . comfort-grip I-beam handle . . . handy pipe scale on hookjaw . . . easy-spinning adjusting nut . . . clean grip on pipe, no slip or lock.

It lasts longer . . . first guaranteed housing, won't break or bind . . . ever. Every wrench individually tested before shipment . . . and millions of them in use. Sizes 6" to 60"—end pattern, 6" to 36".

For the most for your money, buy RIDGID . . . Your local Supply House stocks them for you, delivers them fast!

THE RIDGE TOOL COMPANY • ELYRIA, OHIO, U. S. A.

RIDGID
Work-Saver Pipe Tools

with recycle hydrogen, and with recycle and make-up hydrogen; gives flow diagram, operating variables, process conditions, economic evaluation, unit operating cost, and the effect of various operating parameters. Foster Wheeler Corp., 165 Bdwy., New York 6, N. Y.

Circle No. **54** *on Reply Card*

Continuous Line Mixer

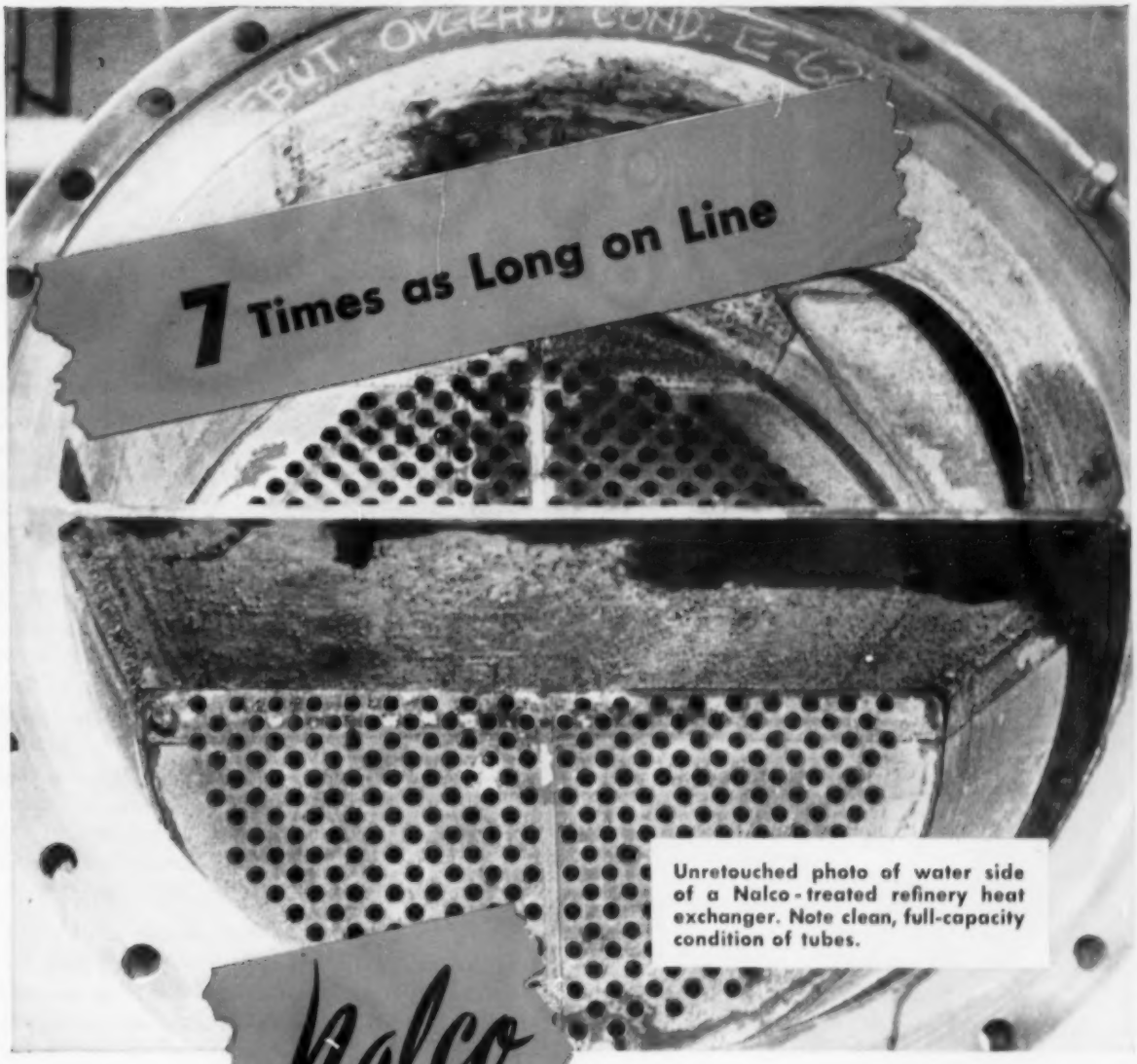
. . . **is for liquid, gas or slurry mixtures.** Working directly in the pipeline and providing uniform blending of one or more chemicals into the main stream without the use of a mixing tank, the "Homomix" is designed and built with one or more stages, each of which consists of a diffusing impeller rotating in a blending chamber, driven by a continuous shaft direct-connected to the prime mover or motor, and discharging directly across the flow-through stream. Visual examination of the mixing action is provided by a transparent plastic observation port which may be opened for physical examination of the rotating element. Installation may be vertical, horizontal or inclined in any pipeline. Head loss is low, but if additional head is required, a lift-stage employing an axial flow impeller may be incorporated in the unit. Interior surfaces of the body and diffusing chambers may be protectively coated. The "Homomix" can be used indoors or outdoors. American Well Works, Aurora, Ill.

Circle No. **55** *on Reply Card*

Rotary Tank Cleaner

. . . **has pneumatically rotated jet** for cleaning which delivers two powerful streams of hot or cold water, with or without detergents, and can clean the entire surface of any shaped tank. One man can handle the tank cleaning operation without assistance. The "Rotor Jet" is lowered through the tank access by means of its supply hose, and its operation is controlled from the outside so that workmen do not have to enter the tank. The three-dimensional movement of the jet assures complete coverage of the inside of the tank. Cleaning speeds are adjustable with high speeds for light cleaning or rinse, and slow speeds for heavy cleaning. The two jets are powered by a venturi-injector which provides high velocity streams to give a scrubbing action rather than a cascading action. The jet head is rotated pneumatically. The "Rotor Jet" is available in three models for capacities from 600 to 6000 gpm. Sellers Injector Corp., 1603K Hamilton Street, Philadelphia 30, Pa.

Circle No. **56** *on Reply Card*


7 Times as Long on Line
Unretouched photo of water side of a Nalco-treated refinery heat exchanger. Note clean, full-capacity condition of tubes.

SINCE Nalco TREATMENT TOOK OVER

This refinery heat exchanger was a prize example of plugging and corrosion headaches before Nalco System treatment was applied to the cooling water. After *7 times as long* as average previous runs, the exchanger was opened for inspection and found clean and corrosion free.

Consider your system. How much would you save by drastically cutting . . . perhaps even eliminating . . . the number of manual or mechanical cleanings of heat exchangers? Certainly it is substantial . . . more than enough to warrant writing or calling, TODAY, for more information from Nalco.

NATIONAL ALUMINATE CORPORATION

Telephone POrtsmouth 7-7240

6258 W. 66th Place • Chicago 38, Illinois

In Canada: Alchem Limited, Burlington, Ontario

THE Nalco® SYSTEM . . . Serving Industry through Practical Applied Science

(To obtain more data on advertised products see page 1056)

KING SIZE

This giant 37 ton Cat Poly Reactor is one of 4 units shipped to a large petroleum refinery in the State of Washington. It is 4'-3½" in diameter by 32'-0" long and has a 1 3/16" thick shell. Each of its 8" thick heads is attached to the shell channel with 28 special alloy stud bolts 2¾" diameter by 15¼" long having nuts 4¼" across the flats. Into the 5¾" thick tube sheets 190 tubes, 2½" O. D., No. 5 gauge and 30'-0" long, are rolled and seal welded. Designed for 1,230 lbs. pressure on the tube side, the reactor was completely X-rayed and stress relieved.

Vogt, a leading builder of shell and tube reactors for poly plants, has the competently skilled personnel and modern mechanical facilities with which to provide heat transfer equipment for the most exacting services in petroleum refineries, chemical plants, and related industries.

Reactors ...by Vogt

A bulletin describing the wide range of heat transfer equipment built by Vogt is available upon request.

HENRY VOGT MACHINE CO., LOUISVILLE, KENTUCKY

BRANCH OFFICES: NEW YORK, CHICAGO, CLEVELAND, DALLAS, PHILADELPHIA, ST. LOUIS, CHARLESTON, W. VA.

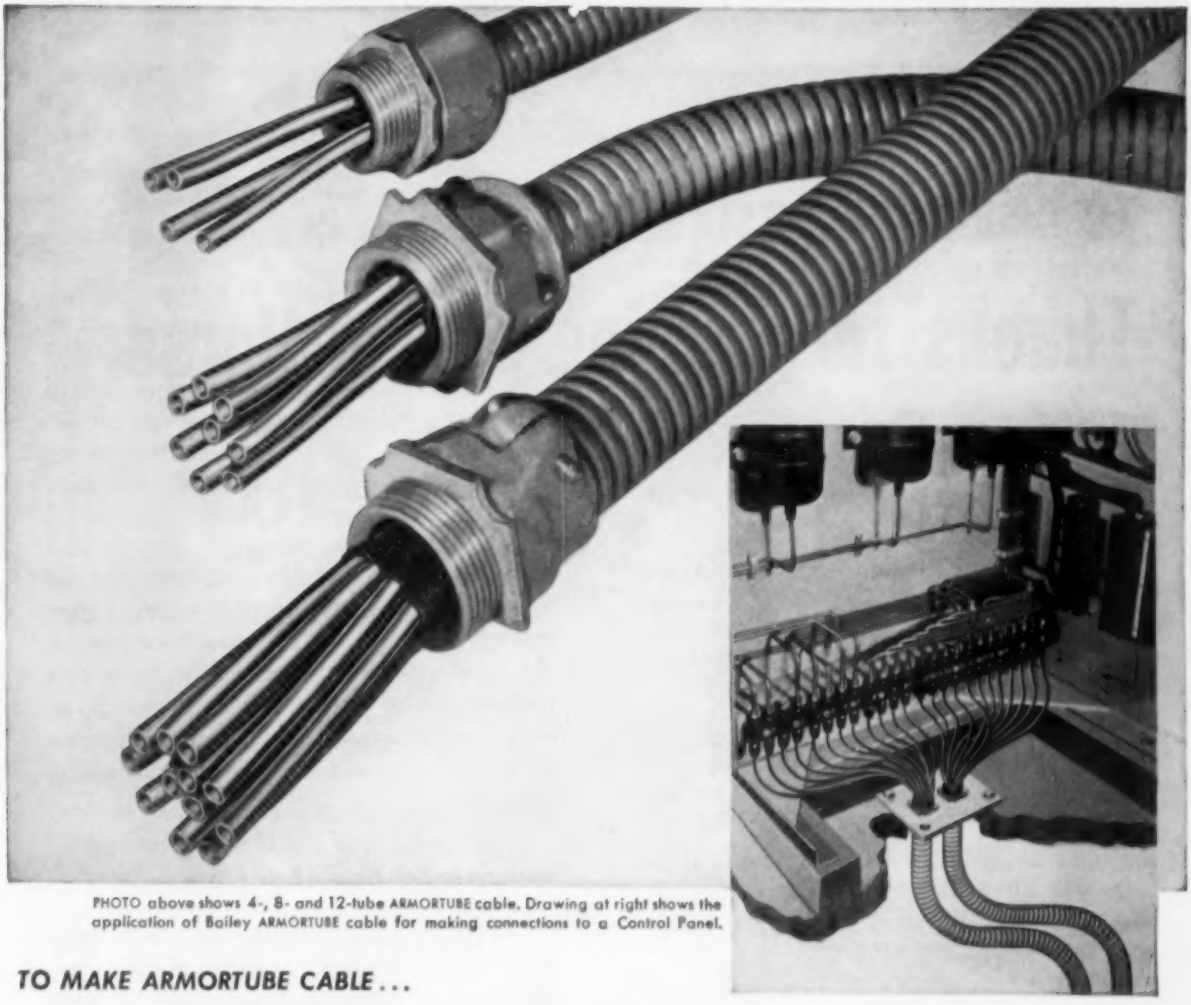


PHOTO above shows 4-, 8- and 12-tube ARMORTUBE cable. Drawing at right shows the application of Bailey ARMORTUBE cable for making connections to a Control Panel.

TO MAKE ARMORTUBE CABLE . . .

Bailey Meter Company turns to Anaconda for long lengths of ¼" O. D. copper tubes

Bailey Meter Co., Cleveland, Ohio, calls its ARMORTUBE Flexible Protected Tube Cable, "the modern shortcut to simpler, safer, more economical air and hydraulic circuits."

As shown above, this cable is available in bundles of four, eight or twelve ¼" O.D. copper tubes. A continuous, heavy galvanized steel strip protects the tube bundle.

Here's why Bailey turned to Anaconda as the logical source of supply for these ¼" O.D. copper tubes.

LONG LENGTHS

Because ARMORTUBE cable is shipped in random lengths of about 500 feet, Bailey needed long lengths of copper tube. Anaconda makes copper tube up to 2,400 feet long, depending on the diameter.

CLEAN INTERIORS

These tubes had to be free from dust, dirt or metal chips which might otherwise interfere with the operation of delicate air and hydraulic circuits. Anaconda takes special care to see that inside surfaces of ANACONDA Copper Tubes are clean, smooth and bright. Tube ends are sealed to keep out moisture and foreign matter during storage.

FLEXIBLE

Tubes had to be flexible enough to bend around corners and obstacles. ANACONDA Copper Tubes are uniformly soft . . . highly flexible. And they are accurate in size and shape.

ANACONDA Dehydrated Copper Tubes are made in all standard sizes up to and including ⅝" O.D. Usually furnished in 25-, 50- and 100-foot coils, they are also available in longer lengths on spools and reels where required.

Our Technical Department will be happy to lend a hand on any problem involving the use of copper tubes. A letter outlining your problem will bring a prompt answer. Write to: The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont.

54158

ANACONDA®

COPPER TUBES

(To obtain more data on advertised products see page 1056)

TO AMERICAN BUSINESS...

Thanks for Taming a Wild Horse

This is a message of appreciation to American industry. The occasion for the message is the completion of our eighth annual McGraw-Hill Survey of Business' Plans for New Plants and Equipment.

To a considerable degree, our appreciation is personal. It goes to the companies whose cooperation made our survey possible. Twice as many companies as in any previous McGraw-Hill annual survey carefully answered our questions about their plans to invest in new producing facilities. They gave a great deal of expensive time to the job. The cooperation of these companies, which employ nearly eight million workers, put the results of our survey on the firmest footing, in terms of coverage, it has ever had. For this cooperation we are most grateful.

But our appreciation is much more than personal. It extends in even greater degree to the kind of planning of investment in new plants and equipment which our survey revealed. The nature of this planning holds out promise that American industry is on the way toward bringing under control what historically has been one of the most upsetting forces in the American economy—the violent fluctuations in business capital investment. Progress in ironing out these fluctuations gives occasion for public gratitude.

A full report of the results of the eighth annual McGraw-Hill Survey of Business' Plans for New Plants and Equipment will be sent to anyone requesting it from the Department of Economics, McGraw-Hill Publishing Company, Inc., 330 West 42nd Street, New York 36, N. Y.

Very Good Business News

The part of our surveys that attracts the widest interest is the news they give about immediate business prospects. And this year the news is very good. The survey results indicate that American business as a whole plans to invest $29.5 billion in new plants and equipment this year. That is 5% more than was invested last year, and a new high for any year.

Plans for the years 1956-1958 are also remarkably encouraging in terms of the amount of investment in prospect. American business reports that it is already planning to spend within 3% as much for new plants and equipment in 1956 as in 1955. In the past, the expenditures planned for future years have always been sharply lower than those planned for the current year. This is understandable enough. It is sometimes impossible to anticipate all the expenditures that will be necessary a year or more hence. Thus the fact that plans are already made

to spend almost as much in 1956 as this year is very good news about business prospects. The level of investment now planned for the years 1957 and 1958 is also remarkably high — far higher than ever reported for years that far ahead in previous McGraw-Hill surveys.

Taking the Long View

The fact that these plans exist is of immense constructive significance. It clearly indicates that more and more, and now in dramatic degree, American business is taking the long view in making its plans for capital investment. It is developing a program which, if successfully carried out, will go far toward eliminating the habitual, destructive surging and sagging of what is in effect the central power house of our economic system — capital investment by business. Upon the level of this investment depends not only the general state of our prosperity but our progress in raising the American standard of living with new products and new and better industrial processes.

Seven years ago, when we first asked industry to estimate its capital spending beyond the current year, only a small minority of companies could give us any estimates at all. This year, 87% of the cooperating companies—and it was a far larger number of companies—could comply with our request for estimates for the years 1956-1958.

It Pays to Bet on Growth

A number of developments help explain the increase in long-range planning of capital investment. One is the increasing technical complexity of American industry. It often takes longer, in this complicated age, to work out a successful installation of new plants and equipment. Another reason for long-range planning is American business management's increasing conviction that it pays to bet on the demonstrated capacity of the American economy to grow over the long pull. With this goes a corresponding determination not to let short-term business fluctuations upset individual company plans for growth through addition of new plants and equipment. An additional factor, and one of great and increasing importance, is the sense of public responsibility on the part of American business leaders who want to help prevent destructive swings in the levels of new investment.

It cannot be too strongly emphasized that there is still nothing automatic about the carrying out of these long-range plans for business spending. Actual expenditures are still governed in major degree by the general health of our economy. This is fully attested by the fact that the current business recovery has led to a substantial upward revision of the investment plans reported to us last fall when we made a preliminary check of plans for 1955. Either private economic excesses or a reversal of the recent improvements in federal tax policy could gravely upset realization of present plans. Fortunately, neither of these possibilities seems to be an immediate threat.

The very fact, however, that American business management has made these plans and will do its utmost to carry them out is a development of tremendous constructive importance for the American economy. It means that major efforts are being made to tame what historically has been an economic wild horse—the process of capital investment by business. Both for doing it, and for telling us about it in our annual surveys, we extend to American industry our sincere thanks.

This message is one of a series prepared by the McGraw-Hill Department of Economics to help increase public knowledge and understanding of important nationwide developments that are of particular concern to the business and professional community served by our industrial and technical publications.

Permission is freely extended to newspapers, groups or individuals to quote or reprint all or parts of the text.

Donald C. McGraw

PRESIDENT

McGRAW-HILL PUBLISHING COMPANY, INC.

EDITORIALS . . .

We'll Still Say "Petrochemical"

THE American Chemical Society has recently taken it upon itself to restrict the use of the word "petrochemical" outside the field of geology. We resent that action, since we and a lot of other people use the word quite frequently to identify a chemical derived or recovered from petroleum or natural gas. Now it appears that we shouldn't.

At its recent meeting in Cincinnati, the ACS council approved a recommendation from the society's Nomenclature, Spelling and Pronunciation Committee to the effect that:

1—The word "petrochemistry" be limited in use under all circumstances to mean "rock chemistry."

2—The word "petrochemical" as an adjective be used only with the rock chemist's meaning in scientific writing and discourse.

3—The word "petrochemical" as used in the petroleum industry, either as a noun or an adjective, is suitable only for popular use, as in industry and commerce.

This audacious attempt to tell an industry which annually produces over $3-billion worth of chemicals from petroleum and natural gas that its name "is suitable only for popular use" appears to us to be a little outside the scope of ACS activities.

Not that we blame the ACS council for following the recommendations of its nomenclature committee. That's to be expected. But the committee, it seems to us, should have been a little less gullible in heeding the demands of a minority but vociferous group of rock chemists who seem to think the term "petrochemical" is their own private property.

We don't disagree with the argument that the word in present usage is etymologically improper. But so also is the very word "petroleum" if one wants to be thoroughly and scientifically correct.

Neither do we disagree with restricting the meaning of "petrochemistry" to rock chemistry. But we do contend that the word "petrochemicals" as it is commonly used has a definite and proper place in our language. We also contend that usage is a much stronger judge of whether or not a word is good than is that word's pure root meaning.

If the rock chemists had their way, there'd be no usage of the term except as applied to rocks (although they admit that it is not in use as a noun to mean a chemical from rocks). They'd like to recapture the term, after having permitted it to wander freely for over 12 years, and put it back in their archives to gather dust.

All of which impresses us as being a bit of a foolish fuss, and a waste of a lot of time by a lot of people on a situation that isn't going to be changed one bit by what a few pseudo purists think.

We suspect that this action of the ACS will have little if any effect on the generally accepted meaning of the word "petrochemical"—and that both the members and non-members of the society will continue to use the word as they have in the past dozen years.

We're going to!

FPC Goofed—Again!

HERE'S another good example of why the Federal Government should get out of the business of setting rates for the well-head sale of natural gas.

Stanolind Oil and Gas Co. is the major producer of gas from the Woodlawn field in East Texas, serving as unit operator for some 70 working interest owners. The gas Stanolind produces is sold under contract to the Mississippi River Fuel Corp., an interstate gas pipeline. Under terms of the contract signed in 1951 between Stanolind and Mississippi River Fuel, a 0.5¢/Mcf. rate increase was called for this year.

But the Federal Power Commission now has to approve such increases, as a result of the Supreme Court decision in the famous Phillips case of last year. Accordingly, Stanolind filed an application for the rate increase on behalf of itself and all working interest owners except three—Gulf Oil Corp., Continental Oil Co. and Phillips Petroleum Co. Each of these three elected to file its own application.

On April 1, FPC denied the proposed increase sought by Stanolind, Continental, Phillips and the individual interests which Stanolind represented. The reason: "the increased rates and charges have not been shown to be justified and may be unjust, unreasonable and unduly discriminatory or preferential or otherwise unlawful."

But five days later, on April 6, FPC wrote Gulf to the effect that its rate filing had been found "acceptable for filing, to be effective as of the date below (April 3)."

Mind you, this gas on which Gulf is now permitted to collect a higher price is all produced by Stanolind from the same reservoir, and sold by Stanolind under contract to a single purchaser. Payment for all the gas is made by the purchaser to Stanolind, which in turn makes payments to the individual working interest owners—including Gulf.

As a Stanolind spokesman points out, the case illustrates graphically what happens when a federal agency in Washington, which knows nothing about conditions in the field, is charged with setting rates and other terms governing production.

And if federal regulation of gas producers is allowed to continue, what's to prevent similar regulation of oil producers—and eventually of the refiners and marketers of finished petroleum products?

Now–A Full Line of

B&A Radioisotope Reagents

Including Carbon-14 Labeled Compounds and Deuterated Compounds

Announcing an

Important New Service

for Industrial, Scientific

and Research Laboratories

BAKER & ADAMSON®
Reagents

GENERAL CHEMICAL DIVISION
ALLIED CHEMICAL & DYE CORPORATION
40 Rector Street, New York 6, N. Y.

Radioisotope reagents provide industrial and research chemists with unique new tools for scientific advancement. Their potential is tremendous and challenging . . . opening broad new areas of investigation in heavy industry, agriculture, biochemistry, medicine, and fundamental research.

For example, with radiochemicals industrial chemists are tracing complex flow of liquids and gases . . . measuring wear and abrasion . . . determining performance of new chemical agents . . . solving problems once considered impossible.

To supply this growing demand, Baker & Adamson now offers an extensive line of radiochemicals for general laboratory use. Included are organic and inorganic radioisotopes, including Carbon-14 labeled compounds and deuterated compounds, produced for B&A by Tracerlab, Inc.

SPECIAL CATALOG—A catalog on B&A Radiochemicals is now ready for distribution. It contains product listings, formulae, specific activities, and details on obtaining necessary Atomic Energy Commission authorization. This valuable catalog serves as an introduction to the whole field of research with radioactive chemicals. For your free copy, attach coupon to your letterhead and mail today.

Attach to your letterhead and mail.

BAKER & ADAMSON PRODUCTS, GENERAL CHEMICAL DIVISION
ALLIED CHEMICAL & DYE CORPORATION
40 Rector Street, New York 6, N. Y.

Please send a copy of catalog, "Baker & Adamson Radiochemicals"

Name _____ Position _____

Company _____

Address _____

City _____ Zone _____ State _____ PP-7

One for Two

Modernization of the 4-B crude unit of Lion Oil Refining Company, El Dorado, Arkansas, called for a single fractionator to replace an old fractionator and an evaporator.

The vessel, 11 feet in diameter, 100 feet long, and equipped with 28 stainless steel trays, was fabricated in Wyatt's Dallas plant. It was the tallest and heaviest vessel ever installed by Lion's maintenance crews.

Along with carrying its double load, it has improved yields and efficiency.

Wyatt's

HOUSTON-DALLAS-NEW YORK-TULSA

MANUFACTURERS AND ERECTORS SINCE 1913